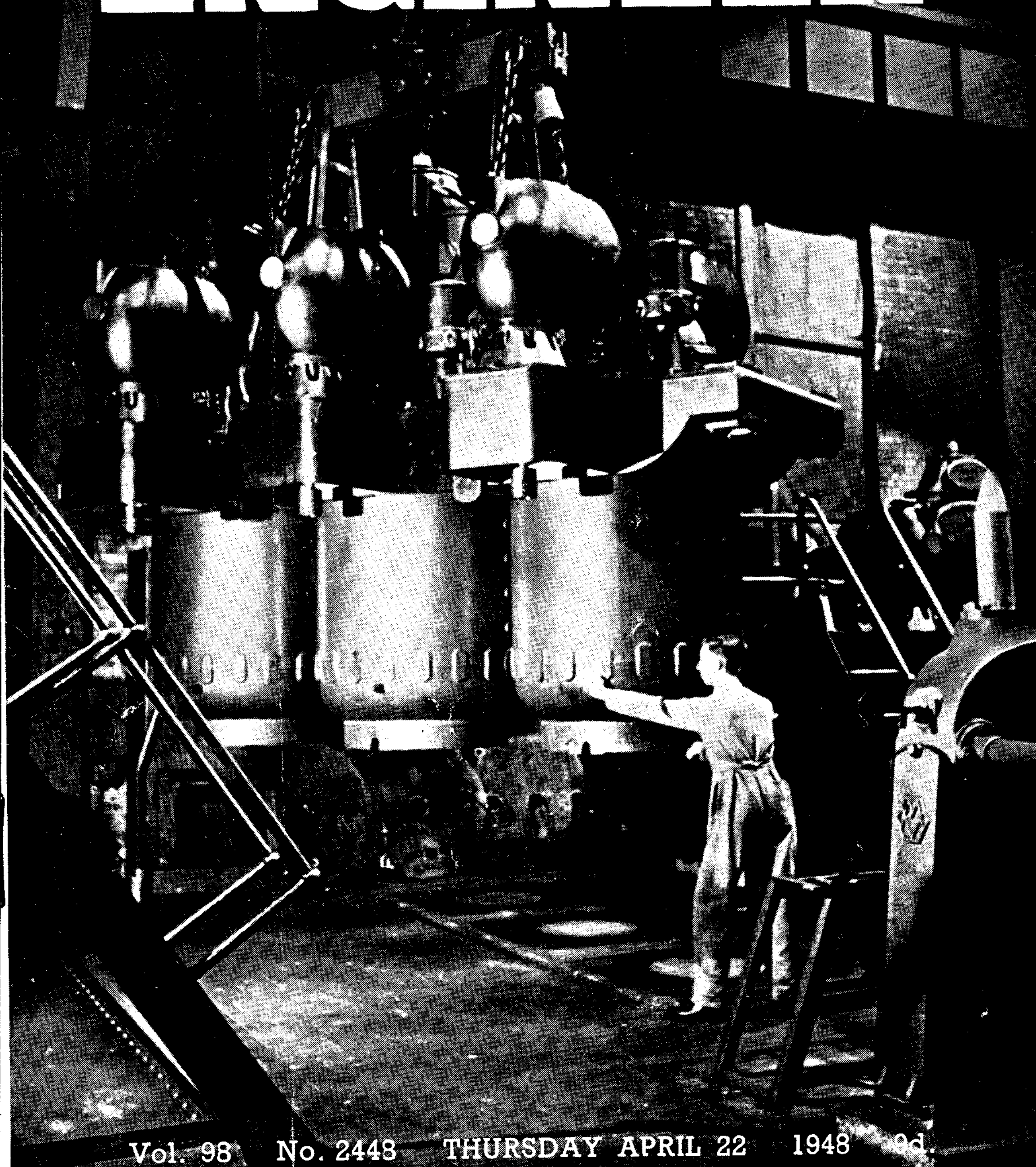
THE MODEL ENGINEER



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The MODEL ENGINEER

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DEATH OF MR. PERCIVAL MARSHALL

AS we close this issue for Press we learn with deep regret of the death on Saturday, April 10th, of Mr. Percival Marshall, our editor, who fifty years ago launched THE MODEL ENGINEER as a new publication, and in so doing founded the publishing house which now bears his name.

By his death the hobby of model engineering has lost its best known and certainly its most loved personality. Many thousands of letters from readers all over the world have told how much his kindly wisdom and philosophical style have been appreciated ; the friendly personal touch so typical of "Ours" is the result of years of guidance from his editorial pen.

For some months Mr. Marshall had been in poor health, but continued to write his "Smoke Rings" until the middle of March this year, and none of those who were privileged to work with him ever heard him complain.

His death is a great loss to our hobby and a deep personal loss to those who were in daily contact with him. His life's work was well done, and the movement, to the growth of which he was so devoted, will carry on to greater strength because of the sure foundation upon which it was built by him.

SMOKE RINGS

Our Cover Picture

● THIS WEEK the photograph which we have reproduced shows a section of a 66 kV, 1,500 MVA switch constructed by Metropolitan-Vickers Limited, for the Battersea Power Station. To many of us the term electric switch signifies nothing more than the wall switch controlling the lights in our homes, or at most the lever attached to the fusebox under the stairs, used only when we lock up the house and start off on our annual holidays. For such as these, this huge machinery gives some indication of the complexity of the problems which arise in dealing with really large currents.

The Model Car Association

● AT AN open general meeting held at the Kingsway Hall, London, on Friday, April 2nd, the Model Car Association officially came into being. Mr. Curwen of the Pioneer Racing Car Club was elected chairman, Mr. Buck of the North Staffordshire Models Society vice-chairman, Mr. G. E. Jackson of the Derby Model Racing Club secretary-treasurer, and Messrs. Denman and Zere, auditors. It was decided that the committee should comprise the officers plus one member from each affiliated club. The club committee member to be nominated by the club. With this purpose in view, all known clubs are

being sent a copy of the provisional rules which were drawn up by the preliminary committee. These rules will be subject to modification and ratification. A proviso unanimously agreed upon was "... that no individual actively connected with the Model Car Trade or the Model Car Press shall be eligible as a member of the executive committee of the Association or allowed to act otherwise than in an advisory capacity." It is expected that clubs will give due regard to this proviso when nominating their representatives. Now that a start has been made it is possible to begin to organise model car racing and development upon a national basis, and the time when all-British and also International competitions can be held becomes a practical possibility. The enthusiasm and popularity of this movement is rising fast, not only in this country, but in all parts of the world where full-size car development is a major factor in the national life. A future of great possibilities lies before the association, but much work remains to be done. The most difficult step—making a start—has been achieved; and model car enthusiasts should be grateful to those members of the provisional committee, who gave their time and assistance, and to the officers of the new committee, especially to the new secretary, whose enthusiasm is such that in addition to carrying a heavy burden of work and responsibility, he is prepared to travel from Derby to London to attend committee meetings. We wish the Association good fortune, wisdom in its decisions and may all whose interests are concerned with model cars benefit by its existence.

The Model Railway Club Exhibition

● THE CENTRAL HALL, Westminster, during Easter Week, was the scene of seething crowds of model railway enthusiasts, old and young—some of them, perhaps, too young!—all intent on enjoying the fascination of railways and every kind of railway equipment in miniature. The exhibition, in its size, scope and generally good quality was certainly one of the best ever held. The models were, of course, mainly of the usual small model railway scales, $3\frac{1}{2}$, 4, 7 and 10 mm. to the foot, with the locomotives propelled by specially-designed miniature electric motors. One of the latter was quite an outstanding product in being a half-size reduction of a well-known commercial miniature motor; it was about 1 in. in total length, $\frac{1}{2}$ in. in height and not more than $\frac{7}{16}$ in. wide, and was fitted with a 5-pole armature $\frac{1}{4}$ in. diameter. At the other extreme, the passenger-carrying track with its 5-in. gauge steam locomotives was as busy as ever; it was the most popular feature of the show to all who were not connoisseurs of the strictly miniature model railway.

For Whom the Bell Rings

● WE HAVE received a letter from Mr. E. G. Anslow, who is secretary of the Nuneaton and District Society of Model Engineers, telling of the local public support for an exhibition organised by this comparatively small society. He writes :—"We are not yet strong enough, or wealthy enough, to run a full-sized show, and the idea behind this exhibition was to advertise ourselves to the public and so invite new members. We had a very representative collection of thirty-two models and a passenger track in operation (made possible by the generous loan of the track by the Coventry Society). We had good support from the local Press previous to the show, but quite frankly, the number of people that turned up astonished us all—over 600 in three hours! We have up to now enrolled three new members as a result of the exhibition, and although admission was free, we had an expenses fund collecting-box situated at the door, and the response was most generous. Incidentally, all the models shown were the work of members. We have had a struggle to keep going since our inception last July and we have been repeatedly told that we would never have a really successful club in Nuneaton, because the model engineers were just not there. Personally, I considered this to be ridiculous, and think we have finally buried that bogey. Rather an interesting story is connected with this show and your paper. A resident of Nuneaton missed all local publicity and has been unable to obtain THE MODEL ENGINEER for over a year. While in Plymouth at Easter he happened quite by chance to see a spare 'M.E.' on a bookstall and bought it. There facing him in the club news was the announcement of our show—his first intimation that a club even existed in Nuneaton. We have now enrolled him as a member. So the good old 'M.E.' 'rang the bell' again!" We hope that the bell will continue to ring for Nuneaton and never toll.

A Reminiscence of Crewe

● A WELL-KNOWN model maker who rather specialises in model yachts and ships recalls that, in the 1890's, his ambition was to become a locomotive engineer. His early training for that career, however, caused him to change his ideas and adopt an entirely different profession. That may seem strange; but it happened in this way: In the *Strand Magazine*, about 1894, there was published a series of articles on the construction, at Crewe Works, of a goods locomotive in $27\frac{1}{2}$ hours. These articles aroused the desire to enter the locomotive engineering profession; and so, in August, 1894, our friend entered Crewe Works as a premium apprentice. During the next five years, he says, he was made to realise how young fellows like him should *not* be trained to be engineers. He never spoke to, or was interviewed by anyone higher in authority than the shop foreman; nobody seemed to take the very slightest interest in the apprentices or their welfare, and it is not surprising that, under this very negligent supervision of Mr. F. W. Webb, the apprentices did not develop into very efficient engineers. As a result of this, our friend, at the age of 21, decided to quit engineering for good, and by means of teaching all day and working all night, more or less, he took a couple of university degrees and became a schoolmaster! But evidently the passion for engineering has never been quenched, because, fifty years later, he is making excellent models.

Editor

Making Scale Ships' Fittings

Suitable for motor-yachts, cabin-cruisers, A.S.R.Ls., M.T.Bs. and other "light craft"

by W. J. Hughes

I WELL remember that in the days when I started building power boats, it was difficult to obtain data on deck fittings, or, perhaps more important still to a beginner, on how to make them. Even now, when I have seen many good power boats described in the columns of THE MODEL ENGINEER, I can recall very few instances where the making of the fittings has been described, and then, usually, but briefly—though a notable exception was the *Penang*, described in THE MODEL ENGINEER during the autumn of 1947.

The article to follow is written in the hope that both beginner and experienced builder (but particularly the former), will find something of value therein. Although the fittings to be described were built for an A.S.R.L., many of them, such as fairleads, bollards, windlass, C.Q.R. anchor, ventilators, horn, lifebuoys, side and other lights, and binnacle, can be taken as being suitable for cabin-cruisers, motor-launches, steam- and motor-yachts, and similar craft. Where those on the A.S.R.L. were "galvanised," however, on a smart yacht or cabin-cruiser most of them would be polished gun-metal, or chromium-plated, or even of solid stainless-steel, according to the depth of pocket or inclinations of the owner of the prototype craft.

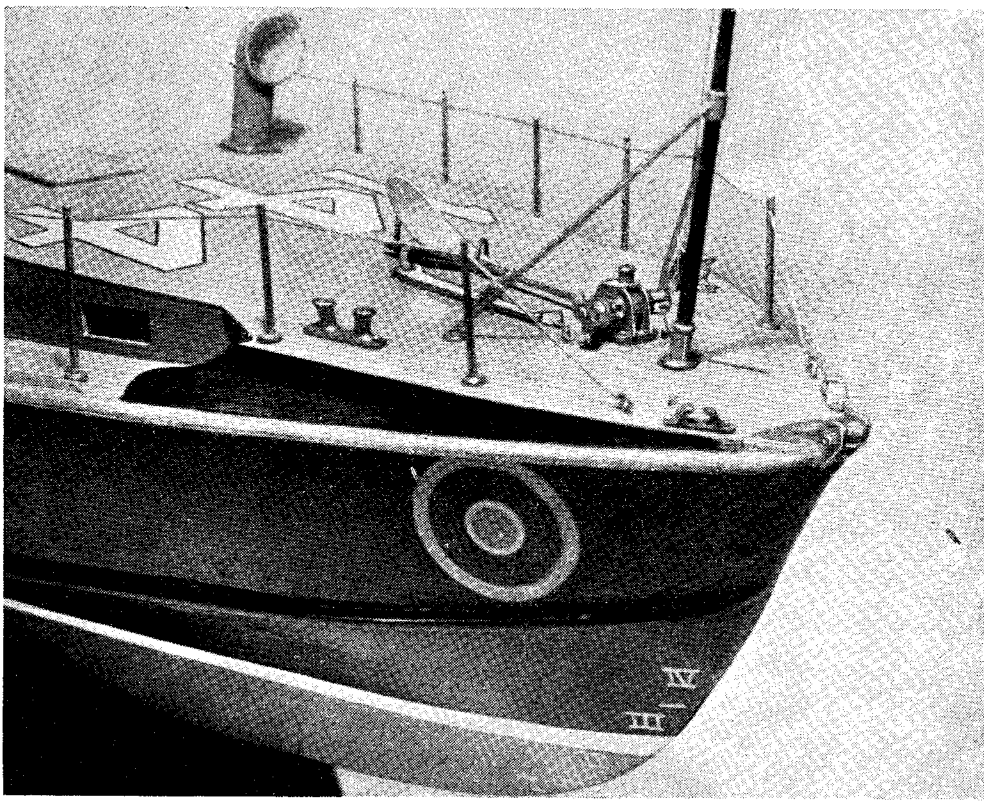


Photo No. 1. Fittings on fore-deck. These include stemhead roller, fairleads, windlass, anchor, raked bollards, stanchions and cowl ventilator

As explained in the article describing my $\frac{1}{2}$-in. scale Walton air/sea rescue launch (MODEL ENGINEER, August 14th, 1947), I obtained the general arrangement prints of the prototype from her builders, and also prints of some of the

fittings from their makers. Windlass, bollards, fairleads, etc., were made by Messrs. Simpson Lawrence of Glasgow, and from this firm I not only obtained prints, but also a thick pre-war catalogue (for the sum of half-a-crown), profusely illustrated and very descriptive! What a mine of information this book has proved Ventilators, side-lights, searchlights, fog-horns, accommodation ladders, mastbands, windlasses, stanchions—all in many shapes and sizes. A book which is worth many times its nominal price!

General Remarks

Unless mentioned specifically otherwise, all my fittings are of brass, which was "tinned" afterwards to represent a galvanised finish. The tinning was carried out with "Fryolux" solder-paint, which is thoroughly to be recommended for use in tinning and sweating operations. (Usual disclaimer—there are other similar solder-paints on the market, but "Fryolux" is the one I happen to have tried.)

The paint consists of very finely powdered soft solder, mixed with an acid flux—though if you object to the latter, solder-paint is obtainable with a non-corrosive flux. I found it desirable

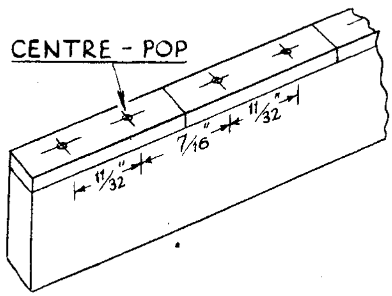


Fig. 1. *Setting-out for bollards*

slightly to dilute it for tinning in order to obtain a thinner coat, and it is painted on with a fine brush. Then a touch of the soldering-bit, or of a gas-flame, and the article is tinned.

In "sweating" two or more pieces together, much time is saved because only one heating is necessary. The paste is painted on each piece; these are then put together and heated, thus tinning and sweating in one operation.

By the way, with an acid flux, the following tip is useful—I obtained it from a fellow club-member, who had it from an old tinsmith. To clean the work after soldering, use a soft cloth damped with *methylated spirits*. It wipes away the residue much more effectively and quickly than a water-damped cloth.

Besides the non-active fluxed solder paint mentioned above, another type has pure tin mixed with the flux, instead of the lead-tin alloy.

All *silver-soldering* was done with "Easyflo" wire 1/32 in. dia., which allows a minimum of solder to be placed exactly where desired—distinctly an asset on small work. I have a small "oven" bent up from sheet-iron—tin-plate would do—and lined with asbestos to conserve and reflect the flame. In shape it is a cube of 3-in. side, with two adjacent sides and part of the top cut away. Using an ordinary small bunsen-burner (laboratory type), it is possible to solder quite large work—small fittings such as these are well within its capacity.

A word of warning here to the novice. If you make such an "oven," which I strongly recommend, *don't* use it for sweating or tinning as well as silver-soldering, because:

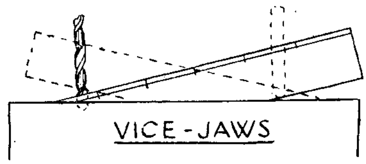


Fig. 2. *Drilling for raked bollards*

(*a*) The fumes of the flux will linger in the asbestos and spoil the "running" of the silver-solder, and

(*b*) any soft solder left behind will alloy with the brass, and the said alloy will disappear when the fitting attains dull-red heat, leaving a hole in the work and a feeling of mild [?] annoyance in the mind of the worker!

Another tip—don't overheat the work. At a bright red heat, brass will burn, which means that corners and thin sections will disappear almost in a flash. "Easyflo" melts at dull red, so why use more heat than that?

Scales and Sizes

Where sizes are given, it should be borne in mind that these fittings are to ½-in. scale, so that if you work to a different scale, your fittings will be appropriately larger or smaller. It will be appreciated too that my boat's prototype is 65 ft. long—if you are modelling a larger boat, it would have more robust fittings. For example, on my A.S.R.L., the bollard base-plates are 11/16 in. long, representing 1 ft. 4½ in., while on a drawing now before me of a 173 ft. motor-yacht, to ¼-in. scale, the bollard base-plate is 13/16 in. long, representing 3 ft. 3 in. Note that owing to the difference in scale, the actual size of the model fitting is not much larger.

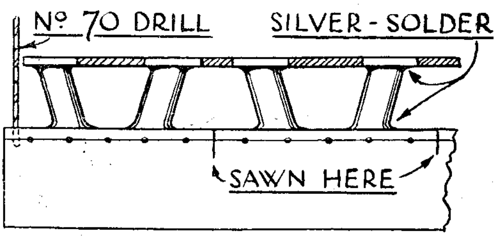


Fig. 3. *Further work on bollards*

Bollards (Photos No. 1 and 2)

As there are four bollards, a method of "mass-production" was evolved, which could be used in making up to a dozen or so at one time.

The edge of a piece of brass strip ½ in. × 3/16 in. section was set out and centre-popped as indicated in Fig. 1. The brass having been set in the vice at an angle (Fig. 2), alternate holes were drilled ⅛ in. diameter, and about ⅛ in. deep (I have no drilling-machine as yet).

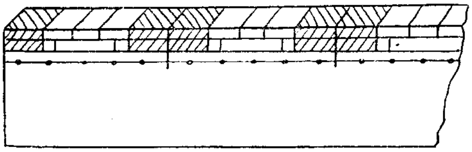


Fig. 4. Setting-out for fairleads

The brass was then set at the opposite angle, and the other holes drilled, as shown by the dotted lines; a fine hacksaw (Eclipse Junior) was used to cut down about $\frac{1}{16}$ in. deep between the base-plates.

After cleaning the upper (drilled) surface with emery-cloth, a short length of ⅛ in. diameter brass-wire was cleaned and cut into eight short stubs, which were pressed and silver-soldered into the holes, allowing a small fillet round the base of each "post."

The tops of the posts were now irregular, of course, and they were filed off level and to length. A strip of 20-gauge brass about 7/32 in. wide was placed along their tops, bound in place with thin iron wire, and silver-soldered to each post, again allowing a small fillet (Fig. 3). This strip having been filed to 3/16 in. wide to match the bases, the parts shown shaded in Fig. 3 were filed away, leaving rectangular flanges on the top of each post; these flanges were filed oval.

Fixing-holes (No. 70) were drilled about $\frac{1}{16}$-in. deep near each end of each base-plate, and all the "get-at-able" corners (e.g., on the oval flanges) were rounded slightly with a fine file. Vigorous use of a strip of medium emery-cloth soon cleaned up the bollards (and incidentally finished removing the sharp corners), and a line was marked and centre-dotted (Fig. 3), so that they could be sawn off accurately. When sawn off, the underside and ends were trued up with a file, and the base-plate corners rounded slightly.

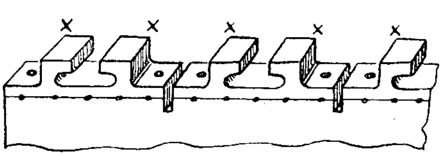


Fig. 5. Fairleads nearly finished. Round corners at "X"

The final operation was tinning to represent galvanising.

Fairleads (Photos No. 1 and 2)

The half-dozen fairleads were produced in a somewhat similar "mass-production" manner, but no silver-soldering of separate pieces was involved.

This time brass strip of ½ in. × ⅛ in. section was used, the edge being set out as Fig. 4, with the exception that the bow pair of fairleads have their grooves set at an angle R.H. and L.H. (Photo 2), and the setting out of this pair must correspond. The waste shown shaded in Fig. 4 was filed away with a square file which, having slightly rounded corners, left a slight fillet in the bottom corners.

Next the slots were cut with a tension-file—a most useful tool and worth its weight in gold for this and similar operations. For the bow fairleads, of course, the filing had to be at the appropriate angle across the work. Fixing-holes were drilled and sawcuts made in readiness for "parting-off" (Fig. 5). The upper corners X-X were rounded, and the sharpness removed from all edges with file and emery-cloth.

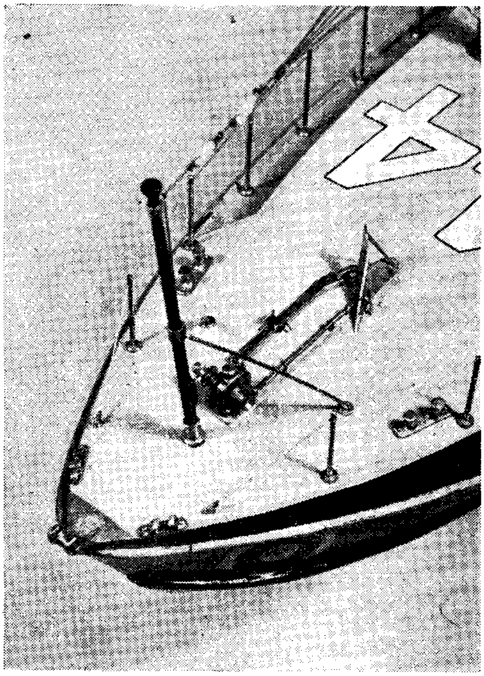


Photo No. 2. Another view of the fore-deck. Note angle of fairleads, handle of windlass and lashing for anchor

The fairleads having been sawn off, the bases were trimmed to the centre-dotted line, ends trimmed up, and base-corners slightly rounded. Tinning completed the job.

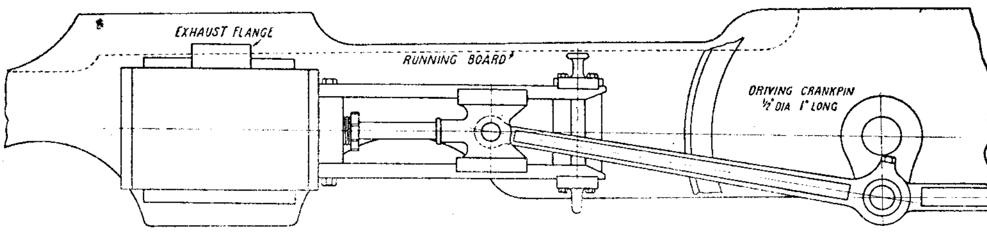
By the way, in case it should be asked why not use ⅛ in. × 3/16 in. strip for the fairleads, instead of forming them on ⅛ in. × ½ in. and sawing off, the answer is that the latter gives something solid to hold in the vice, and I think that this is sufficient recompense for the extra time involved in sawing-off and cleaning-up. This applies also to the bollards.

(To be continued)

"Maid of Kent"

Outside Cylinder Guide-Bars—by "L.B.S.C."

As a gesture of goodwill towards Inspector Meticulous and all his friends and relatives, I have shown the outside-cylinder guide-bars attached to the gland bosses by screws, something after the style of full-size practice; but the spigot attachment can, of course, be used by anybody who prefers it. In that case, the gland bosses are finished off and drilled as described for the inside cylinders, and the ends of the guide-bars turned down to suit. As shown in the accompanying illustration, the plain bars are simply $5\frac{1}{4}$-in. lengths of $\frac{1}{4}$-in. by $\frac{3}{8}$-in. steel bar, silver-steel being about the most suitable, as it is usually dead true, and gives great length of service, owing to resistance to wear. Beginners frequently ask why I don't specify rustless steel for guide-bars, and if there is any objection to using it. None at all; the only thing is that it is a comparatively unnecessary refinement, as the bars are always oily (they are on my engines, any-old-how!) and so ordinary steel has no chance to rust. Cut the bars to length and bevel off one end as shown. On the assembly sketch I have shown the bars attached to the gland bosses by a single $\frac{3}{16}$-in. hexagon-headed screw; and for this attachment, drill a No. 12 hole in the butt end. As both Whitworth and B.A. screws are of rather too coarse a pitch for this job, make a couple of $\frac{3}{16}$-in. by 40 screws from $\frac{1}{4}$-in. hexagon rod, a "practice job" which needs no detailing.



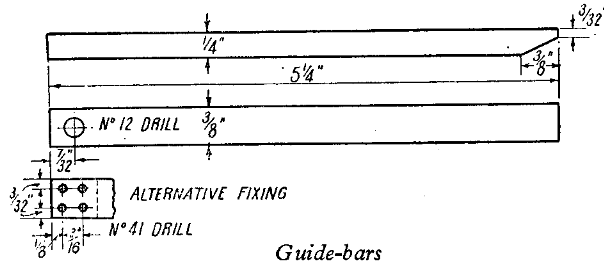
How to erect outside cylinders

Tips for beginners: as the bars must be dead square with the cylinder cover, and absolutely parallel to the piston-rods, square off the butt ends of the bars in the lathe, holding them in the four-jaw and making certain there isn't any pip left in the middle after facing. Then, when squeezed up tight against the machined face of the cylinder cover, they must of necessity be square with it. Run the No. 12 drill through the hole, making a countersink on the seating; drill 5/32 in. and tap $\frac{3}{16}$ in. by 40. Anybody who loves to see a lot of little screwheads, rivet-heads and so forth, on a little engine—and very nice too, as long as efficiency isn't sacrificed for appearance—can drill four No. 40 holes instead of the single big one, and fix the guide-bars by four 3/32-in. or 7-B.A. hexagon-head screws in each. These may seem small for a 5-in. gauge engine, but they are the equivalent of 1-in. bolts, and I don't recollect any guide-bars on the old Brighton engines needing four 1-in. bolts to hold each bar to the cylinder covers. As far as I remember, there were lugs on the back cylinder covers each side of the gland, and the channel-shaped bars on the Stroudley engines fitted over the lugs; one big bolt through bar and lug, nutted underneath, did the needful.

Crossheads

Plain alligator-type crossheads are used with the double bars. These may either be castings, or built up from steel. Bronze castings are perfectly satisfactory, and as in the case of the inside cylinders, work very sweetly on steel bars; anybody objecting to the colour, can easily tin them over. The castings should be smoothed with a file, and chucked in four-jaw for turning the bosses. The recesses for the little-ends could be cleaned out with an end-mill held in the three-jaw, the casting being clamped under the slide-rest tool-holder with the cavity facing the headstock. The grooves at top and bottom can be milled in similar manner, using a $\frac{3}{8}$-in. end-mill, or a home-made slot-drill, and packing the casting to centre height. Built-up steel crossheads can be made by a similar process to that described for making the box crossheads for the "Minx." A piece of 1-in. by $\frac{1}{2}$-in. mild-steel bar sufficient to make the two of them, would be approximately $3\frac{1}{2}$ in. long. Turn the end bosses with the metal held in the four-jaw, then drill the holes for the wrist-pins, saw in half, slot the centre across by milling, as described for the "Minx" crossheads, and file to shape. A piece of $\frac{1}{4}$-in. by $\frac{5}{8}$-in. mild-steel bar about $2\frac{5}{8}$ in. long, will make each pair of shoes. This has a groove $\frac{3}{8}$ in. wide and $\frac{1}{8}$ in. deep, milled in it as per the "Minx" instructions; then cut it in two, and square off each end in the four-jaw, to a length of $1\frac{1}{4}$ in. The shoes are then brazed to the top and bottom of the centre part of the crosshead; and it is, of course, absolutely necessary that both shoes should be exactly

parallel with the centre part, and with each other. For jobs like these, I use rough home-made cramps, like toolmakers' cramps, made in a few minutes from bits of $\frac{3}{8}$-in. square steel and $\frac{3}{16}$-in. stove screws. The cramps are about 3 in. long, and the screws both placed near one end, leaving plenty of jaw space; and if one of these gadgets is placed with its jaws holding the crosshead shoes to the centre, the shoes can be adjusted to a nicety before tightening the screws. It doesn't matter about the jaws of the cramps getting red-hot when brazing the shoes to the centre, there is nothing to spoil; and when quenching the crosshead after brazing, the cramp comes to no harm if dumped in the cold water along with the job. Things like these are useful to beginners; I use brass ones for holding jobs to be soldered, as they don't go rusty. Four weeny ones come in mighty handy for holding the half-round wire beading to the edge of a tender body whilst soldering it in place, to quote one job only. After soldering the length spanned by the four cramps, they are moved further along, and the process repeated; and so on right around the whole issue.



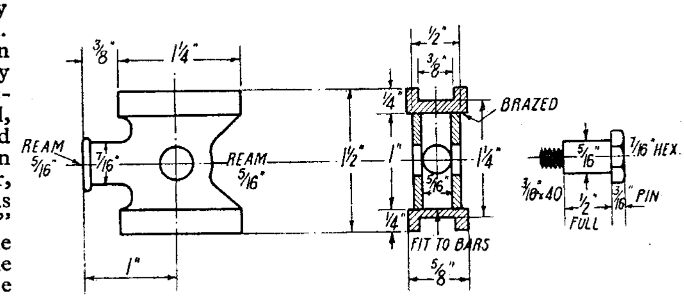
Guide-bars

After cleaning up the crossheads, ream the bosses and the holes for the pins. The pins themselves may be made in either of two ways. The "regulation" way is to turn them from $\frac{7}{16}$-in. hexagon steel rod to the given dimensions, another very simple job needing no instructions; but a simpler way still, is to use a bit of $\frac{5}{16}$-in. round silver-steel shouldered down each end to $\frac{3}{16}$-in. diameter, and screwed $\frac{3}{16}$ in. by 40, as described for the "Minx," though hers were a little smaller. Owing to the fine thread, you'll have to make your own nuts from $\frac{5}{16}$-in. hexagon steel rod; but that job shouldn't worry anybody! When finished, the crossheads should slide easily between the bars, but without appreciable slackness, right up to the gland.

Connecting-rods

As these are made by exactly the same process as the coupling-rods already described, there is no need to go into full details again. The actual rods need two pieces of $1\frac{1}{4}$-in. by $\frac{3}{8}$-in. mild-steel bar, $8\frac{1}{8}$ in. long, but allow a little extra length if the rods are to be roughed out between centres by the late Mr. Averill's method; also, if the recessing and fluting are to be done on a milling-machine, as it is more convenient to bolt the rods to the miller table by clamps holding extension pieces at each end, than by small bolts through the bearing holes As the recesses and flutes come close to the bearing holes, the milling-cutter will bite a piece out of the bolt heads at the end of each cut, and this makes it awkward to stop the cut at the right place. The bushes are simple turning jobs made from phosphor-bronze and squeezed in. The little-end bush is flush both sides of the rod. The big-end bush projects a full $\frac{1}{16}$ in. on the flanged side and 1/32 in. on the other side, that is the plain side of the connecting-rod. This serves a twofold purpose, keeping the connecting-rod lined up with the recess in the crosshead, and preventing rubbing on the coupling-rod boss. It also adds a little to the bearing surface of the most hard-worked bearing on the whole engine.

Drill a $\frac{1}{16}$-in. oil-hole in the oil-box on the big-end, and open it out to $\frac{3}{16}$ in. until the drill just touches the bush. To bring a smile to the face of Inspector Meticulous, you can turn a weeny cap from $\frac{1}{4}$-in. hexagon brass, to squeeze into this. Drill a $\frac{1}{8}$-in. hole through the cap and countersink it before parting-off. Alternatively, you can tap the top of the box 7/32 in. by 40, if you so desire, and screw in the brass cap. We had similar caps in the coupling-rod oil-boxes on the old Brighton engines, and these sometimes were the cause of a few extra words of railroad Esperanto being added to the "list of terms." We used to plug the holes with little plugs made from cane (corks would have prevented the oil feeding down to the pins as they didn't allow air to enter; the cane plugs did) but especially on the D-class



Crossheads

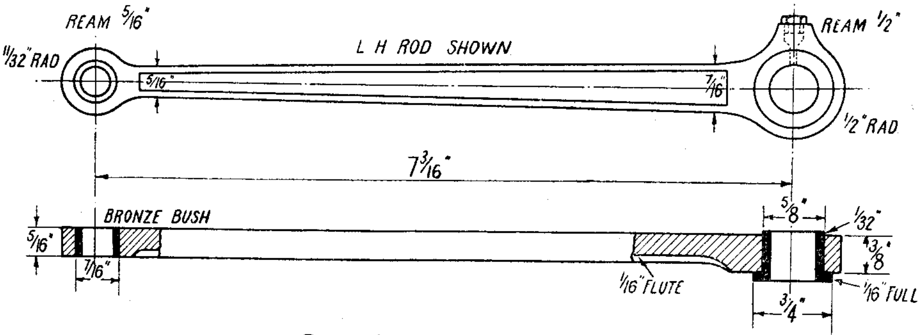
tanks, the coupling-rods ran mighty close to the undersides of the running-boards. If the engine was what we called "down on the springs," and she swayed on curves, or when running through crossing frogs or "diamonds," the projecting ends of the plugs would hit the running-board, and boy—*DID* they want some getting out! I remember one evening in the dim and distant past, we left London Bridge with old 261 *Wigmore* pulling a Dorking train—first stop

Sutton—following fairly closely on the tail of a Wimbledon "roundabout," hauled by a Billinton "watercart," as the radial tanks were sometimes known. Whether the "watercart" was living up to its nickname, or whether the passengers were a bit slow getting in and out, we didn't know for certain; but what we *did* know was that we "ran into their signals" at East Dulwich, and from there to Streatham Junction South it was a weary crawl, with every signal "on." At the latter point the Wimbledon "wanderer" diverged to the right; and as Mitcham down intermediate distant was "off," we promptly "stepped on the gas," as our automobile friends would say. Old *Wigmore* couldn't half go, if she had her head, and the little bit of 1 in 100 down, past the other side of the junction, gave her a good kick-off, so she scooted across Mitcham Common like a Derby winner, and we hit the reverse curve at Mitcham Junction before we were ready for it, and a bit faster than usual. There was no danger, of course; we weren't going "as fast as all that," as my old granny would have said, and the curve is "checked" (that is, it has a check-rail right around it) but old *Wigmore* leaned over first to the left, and then to the right, with the result that the cane plugs in the coupling-rod oilers were knocked in flush with the tops of the brasses, and had to be drilled out. We got back safely by giving her several good doses of oil between the rods and the wheels, and around the retaining-nuts. Those were the days!

Note—with the outside drive, you'll need larger and longer crankpins in the driving-wheels; these should be made from $\frac{1}{2}$-in. diameter silver-steel, and the plain part between the shoulders, on which the big-end and the leading boss of the coupling-rod will operate, should be 1 in. long. As the outside cylinders are arranged for the same length of stroke as the inside cylinders, viz. $2\frac{1}{4}$ in., the pins must be placed $1\frac{1}{8}$ in. from the axle centre.

Guide-bar Brackets or Yokes

Castings will be provided for the guide-bar brackets, or yokes as they are often called, and these will require very little machining. If a milling-machine is available, they can be held "back upwards" in the machine-vice on the table, and the contact surface which goes next to the engine frame, cleaned off with a small slabbing cutter. An ordinary narrow cutter will do, if you take several "bites" without alteration of the vertical adjustment. The contact face could also be end-milled off in the lathe, if the slide-rest tool-holder will take the casting, and allow the end-mill or facing cutter to cover the whole surface. Failing any method of machining the casting could be held in the bench-vice and carefully hand-filed; if it is as clean as some of the sample castings I have recently received from our advertisers it shouldn't want much doing to it at all!



Connecting-rod for outside cylinders

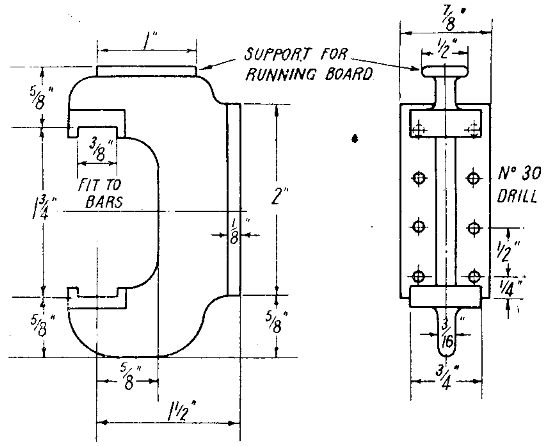
The important thing is, to get the grooves for the bars machined out to an exact fit, and at the same time to correct measurements. The centre-line of the bars should be $1\frac{1}{2}$ in. from the frame, and the bars themselves absolutely parallel to the frame, and to each other, the distance between them being $1\frac{1}{4}$ in. That reminds me:—

There was a young lady named Mary;
In her work she was ever so wary;
And the pins that she ground
Were all dead true and round
Not a single hair's-breadth would they vary.

The guide-bars, when erected, should emulate Mary's handiwork if the engine is to operate with the least possible friction, which won't be the case if they *do* vary from parallelism either with each other, the piston-rod, and the frame; all of which leads up to the fact that extreme care is needed to get the channels in the casting right. Anybody who has a vertical slide for his lathe, can do the job accurately in a very short time, as easily as eating a piece of cake; another illustration of the value of this accessory. All you would have to do would be to bolt the bracket to the slide, same way as it would be bolted to the frames, or by putting a clip over each side flange, setting vertically with a try-square. If you happen to have an end-and-face milling-cutter $1\frac{3}{4}$ in. diameter and $\frac{3}{8}$ in. wide, you are absolutely "in the clover," for one cut will do the needful. Mount it on a stub arbor or mandrel and put it in the three-jaw. Run up the slide-rest, with vertical slide attached and casting in position, until the face of the slide is $1\frac{5}{16}$ in. from the outer face of the cutter. Set the slide so that centre-line of the casting is level with lathe centres; start the lathe, feed the casting straight across the cutter by operating the cross-slide, and, hey-presto—Charlotte is your cousin! Both

channels milled dead parallel and the right distance apart at one fell swoop !

The job could be done with a smaller cutter, using the same rig-up, but in that case the channels would have to be milled separately. By bringing the slide-rest handles to same position when finishing the upper and lower channels, they would come out parallel. If I were doing the job, I should use my vertical miller, holding the casting horizontally in the machine-vice on the table. I have a cutter the right size, and this would be held horizontally with its spindle in the collet chuck. The table would be adjusted so that the underside of the cutter was $1\frac{5}{16}$ in. from the contact face of the casting, and then the table would be traversed across the cutter, the latter cleaning out the two channels at one go, as described above.



Guide yokes or motion brackets

The channels could also be cleaned out on a planing or shaping machine, using a cranked tool in the clapper-box, and holding the casting in the machine-vice. Failing any method of machining, the tool that old man Noah found so jolly useful in the ark, to wit the humble file, can be used to clean out the channels ; and used with what is known as a little " common savvy," will make a very good job of them. The same weapon can be used to smooth off the upper flange of the casting, which will form a support for the running-board. Eight No. 30 holes are drilled in the flanges, as shown, for the screws or bolts attaching the brackets to the frames.

Erection

No special instructions are needed for erecting the whole outfit ; an illustration of it is included, which is practically self-explanatory. Take off the steam-chests, poke the cylinder through hole in frame until the flanges butt up against same, then drill the holes for screws in frame, using those in the cylinder flanges as guides. You can use either bolts, nutted inside or outside as preferred, or drill and tap the frame itself for screws. Erect crosshead and connecting-rod as described for the inside cylinders, except that you don't have to take any brasses apart, simply putting the big-end bush over the crankpin ; then adjust and pin crossheads. Slip the guide-bar brackets over the ends of the bars as shown, and set them so that their vertical centre-line is $5\frac{1}{2}$ in. from the centre of the driving axle, using the holes in the flanges to locate the bolt holes in the frame. As with the cylinders, you can use either bolts ($\frac{1}{8}$-in. or 5-B.A.), through clearing holes in the frame, or drill and tap the frame same pitch, and use set-screws. If the two channels in the bracket have been correctly made, the brackets will automatically line up the bars, and there will be no sign of the crosshead binding when the wheels are turned by hand. As a 5-in. gauge engine has considerable power (you'll find that out for yourself, later on, or I miss my guess !) it will be necessary to attach the outer ends of the bars to the brackets ; and this can be done by drilling a No. 30 hole through the casting into the channel at each side of the central web ; see illustration of assembly, When locating the corresponding holes for the screws in the ends of the bars, have the piston-rod fully extended, so the crosshead is between the jaws ; this will support the bars whilst you make the countersinks on them, through the holes in the casting. Drill the bars No. 40, and tap for $\frac{1}{8}$-in. or 5-B.A. hexagon-head screws. File off any of the screw that projects through the sliding surface of the bar.

Making Her a Compound

Fitted with a pair of outside cylinders as described, the engine won't be the " Maid of Kent " any more, but a close relation to the " Crimson Ramblers," as the L.M.S. Midland type compounds were called. The superstructure of the erstwhile " Maid " should therefore be made to the same pattern as these engines ; and any builder who doesn't mind the extra work, and is game for a little experimenting off his own bat, could easily go the whole hog and make a three-cylinder Smith compound of her. All that would be needed, would be the addition of a single inside cylinder, of the same general type as specified for the " Lassie," but, of course, larger ; $1\frac{1}{2}$ in. bore and $2\frac{1}{4}$ in. stroke would do very well. As it would be an awful squeeze to get six eccentrics and a crank on the driving axle, the inside cylinder could have Joy gear ; you can't use the two-to-one levers, because the two outside cranks are set at 90 deg. or right angles, and the middle one halfway between them, instead of the 120 deg. of an ordinary three-cylinder simple engine. A special arrangement of regulator and steam pipes would be necessary ; I would gladly give the layout of them if any compounds are built. A twin-pump mechanical lubricator would also be needed ; but " sufficient for the day is the evil [!] thereof " says the old saw, and as we now have to tackle the *pons asinorum* of most locomotive builders, the valve-gear, we had better leave the variations until a later date !

A "Double" Repulsion Motor

by J. R. E. Godfrey

HAVING read with considerable interest "Artificer's" excellent continuation of the "Swords into Ploughshares" series, in No. 2,442 of THE MODEL ENGINEER, I am prompted to hope that certain experiences of mine in the same field of enquiry may be of some interest to readers who are considering using one of these small pseudo-motors.

Early in 1947, I bought a motor generator of the "unknown make" type shown in "Artificer's" article on page 267, and proceeded to wire it up in a manner basically the same as that shown in Fig. 3, on page 268. The motor ran very well on 200 volts a.c., but it had two small but very disconcerting faults. The first of these was expected, being a normal characteristic of commutator motors, namely radio interference, although in this case the magnitude of the interference was rather surprising. The second fault came as a complete surprise and manifested itself in a very peculiar manner. With a light load on, the motor would turn at a steady 3-4,000 r.p.m., but on switching off the current it would come to a dead stop with the emission of a noise very reminiscent of the dying cough of a pole-axed bullock. I am not sufficiently well versed in electrical theory to be able to give an authentic explanation of this phenomenon, but it seems likely that reverse currents are induced in the disconnected low-voltage armature windings which, at the moment of switching off, receive a surge which renders them sufficiently powerful to act as a sort of magnetic brake. In this connection, I would like to mention that I checked that there was *not* in fact any form of magnetic brake fitted to the machine and that once the current was off and the machine had performed its uncanny feat (with sound effects), the spindle could be turned quite freely.

I have said that this sudden stopping was a fault, but really it was more of a psychological disadvantage than anything else, as a machine which stops so suddenly is apt to be rather disconcerting to the operator and, in my case, the accompanying noise was considered by my wife as the last word in horrors (since the banshee wailers sent their last mournful cry through our heads), especially when she had just got the baby to sleep. Anyway, I decided to do something about it and after wearing out three sets of fingernails in head-scratching, I arrived at a solution which although far from being original was nevertheless very effective in the end. Briefly, the idea was to convert the motor from series wound to repulsion induction, and the job was carried out as follows:—

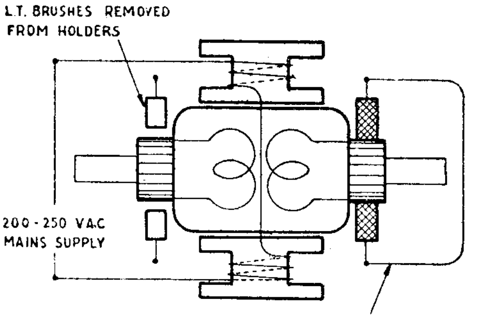


Fig. 1

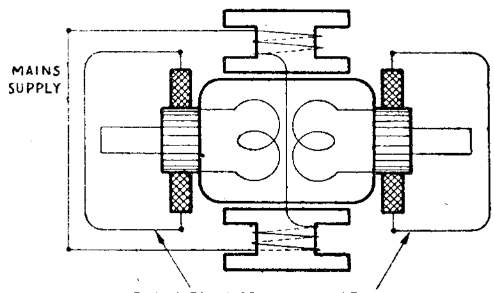


Fig. 2

The leads to the high voltage brush-holders were removed and the brush-holders connected together with a short length of insulated cable. Next, the four screws securing the high-voltage end bearing-bracket to the motor body, were removed. Then this bearing-bracket, which carries with it the high-voltage brush-holders, was turned through an angle of approximately 90 deg. and the securing screws re-inserted but not tightened. Mains current was then applied to the field winding, when it was found that, by adjusting the bearing bracket to a little over or under 90 deg. from its original position, the motor could be made to run in either direction. This final adjustment was made possible by the fact that the securing screw holes in the bearing-bracket are specially elongated to cater for just such a requirement. A position was found, after some trials, at which the motor gave its best performance and the bearing-bracket was secured in that position. The connections were as shown in Fig. 1.

Connected in this way, the motor ran quite well, there being little or no radio interference, since the commutator and brushes were no longer connected to the mains, and when the current was switched off, the machine came to rest in a normal, well-behaved manner. The torque, however, had dropped considerably and was in fact, insufficient for practical purposes, so something had to be done about that. I tried reversing

(*Continued on page* 440)

*Swords into Ploughshares

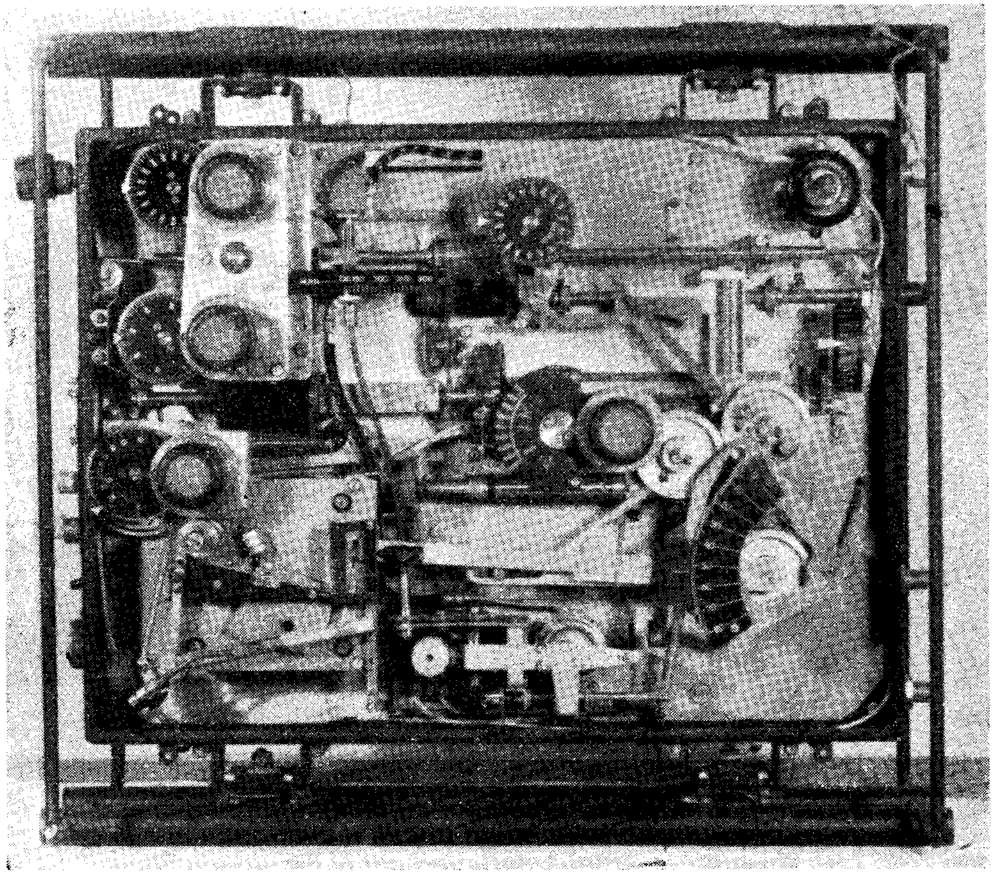
Hints on the adaptation of "surplus" war material for model engineering or utility purposes

Gearing and Mechanism

by "Artificer"

CALCULATING and integrating mechanisms of various kinds have been very extensively employed in instruments for aiding navigation, gunnery or bombing, and many examples of these instruments or their component parts are to be found on the "surplus" market at present. The principles employed in working out calculations by mechanical means are extremely ingenious, and well repay close investigation by anyone interested in mechanical engineering, but quite apart from this, the many useful components such as gearing, ball-races, slides, lead-screws, cams, etc., offer many possibilities in the construction of models and equipment.

In the usual form of mechanical calculator, as used for accounting and similar purposes, the basic data of the calculation (that is, the figures to be added, subtracted, multiplied or divided) are fed into the machine by pressing appropriate keys, and the machine indicates the result, either on a dial or counter, or in the form of a printed record. Many of the instruments now under consideration, however, have the data supplied to them by automatic means, and in turn, pass on their results automatically to other instruments or controls. It is not within the



Bomb sight computor, control panel side showing setting dials ; outer casings removed

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* *Continued from page* 374, "*M.E.*," *April* 8, 1948.

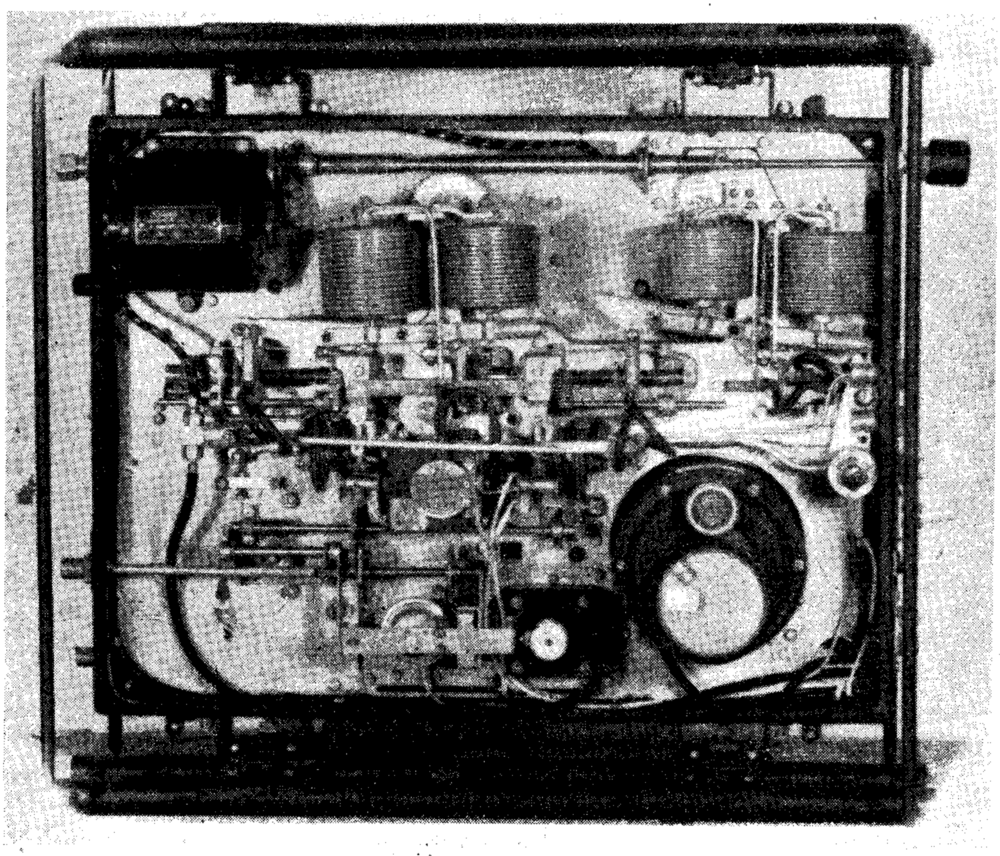
scope of these articles to describe in detail the working of these instruments, in fact it would not be within the power of the writer to do so, as many of them are still on the secret list, and the components or incomplete assemblies which have been released for disposal are inadequate to enable a reconstruction of the complete machine, or its full working principles, to be produced. In other cases, where a complete instrument or assembly is available, it is of the type which functions in conjunction with other instruments, the nature or design of which can only be vaguely surmised.

In the circumstances, therefore, all that is attempted is to give some general information on the machines or instruments available, with a description of their components, and some hints as to the uses to which the latter may be applied.

An example of a calculating instrument which is never (so far as can be ascertained) seen on the market in its complete form, is the "predictor" used in anti-aircraft gunnery for automatic computing and setting of the range, bearing, drift, and other variables which affect accurate firing. Considering that some of the instruments in this class consisted of a closely packed mass of mechanism about as large as a grand piano, it is hardly surprising that they have been stripped down to their sub-assemblies for disposal! (A large number of these sub-assemblies and components, including a wide variety of gears, complete friction drive units, shafts, frames, bearings, dials and motors have been advertised in the MODEL ENGINEER by Educational Models Ltd., of Teddington, and a description has already been given, in these series of articles, of a disc grinder which can be made mainly from these components.)

Air Position Indicator

This instrument is one of the most valuable aids to air navigation ever devised, and constitutes in effect an "automatic log" which will show the pilot his exact position, relative to the starting point, at any point in the course of a flight. It is about the size of a medium-sized typewriter, and embodies a cast aluminium baseplate on which the major components are mounted, and enclosed by a sheet-metal cover, with aperures through which the dials and counters are visible. The underside of the base is recessed, and houses a train of gears which connect and co-relate the components; these also are enclosed by a flat metal plate.



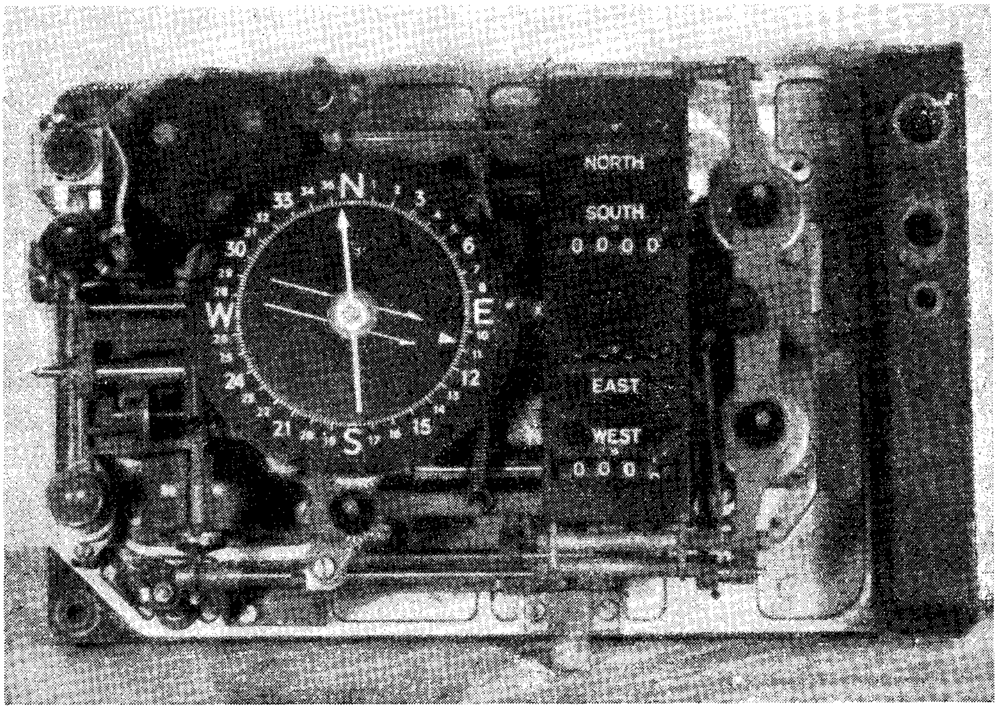
Reverse side of bomb sight computor, showing repeater motor, metal bellows, gyroscope, etc.

The progress of the aircraft, which is possibly recorded by the revolutions of the engines, or more probably by a wind-driven propeller comparable to the well-known "Cherub Log" used in ships, is "fed" into the instrument by means of a flexible shaft, and thence to either or both of two variable friction-drive units which operate the counters. Control of both the ratio and direction of these units is obtained from the compass bearing dial, which is set by a repeater motor to correspond with the direction of flight, as indicated by the navigator's master compass. The friction gear units are of the disc and cylinder type, having a ball or roller between them which can be adjusted along the length of the cylinder, and across the face of the disc. Spring loading of the cylinder bearing frame keeps the components in close contact so that motion of the disc is transmitted through the roller to the cylinder. When the roller is near one edge of the disc, the speed ratio of the drive is at its maximum in one direction ; as the roller moves progressively across the disc, the ratio is reduced until it reaches zero at the centre of the disc. Further adjustment of the roller reverses the motion transmitted to the cylinder, and when it reaches the other edge of the disc, it produces the maximum speed ratio in the other direction.

It will now be understood how the compass bearing dial controls the motion transmitted from the repeater motor to the counters. Assuming that the compass bearing is set due north, the friction gear of the north-south pair of counters is adjusted to its maximum ratio, in such a direction that the motion gives an additive reading to the north. At the same time, the friction gearing which drives the "east-west" pair of counters is in the central or neutral position, so that it transmits no motion at all.

If the compass bearing dial is turned to due south, the friction gear for the "north-south" counters will be set to maximum ratio in the reverse direction, the "east-west" gearing remaining neutral. For due east or west bearing, the "north-south" friction gear is set in the neutral position, and maximum ratio obtained in one or the other direction on the "east-west" friction gearing. In any intermediate angular position, the ratios of the two sets of gearing are adjusted to give the resultant motion on two counters simultaneously.

It should be explained that the pairs of counters "north-south" and "east-west" respectively, are geared so they go out of action at zero and do not record minus readings. Thus, the "south" counter will remain at zero, while plus readings are shown on the "north" counter, and *vice versa*. If, for instance, the reading on the "north" counter is 20, and the aircraft travels 60 degrees due south, the readings will then be north 0, south 40. In this way the confusion which might possibly be caused by the counters showing minus readings is avoided, and the readings are intelligible at a glance. A third friction gear is incorporated in the driving mechanism, and



Air position indicator, viewed from above, with casing removed to show mechanism

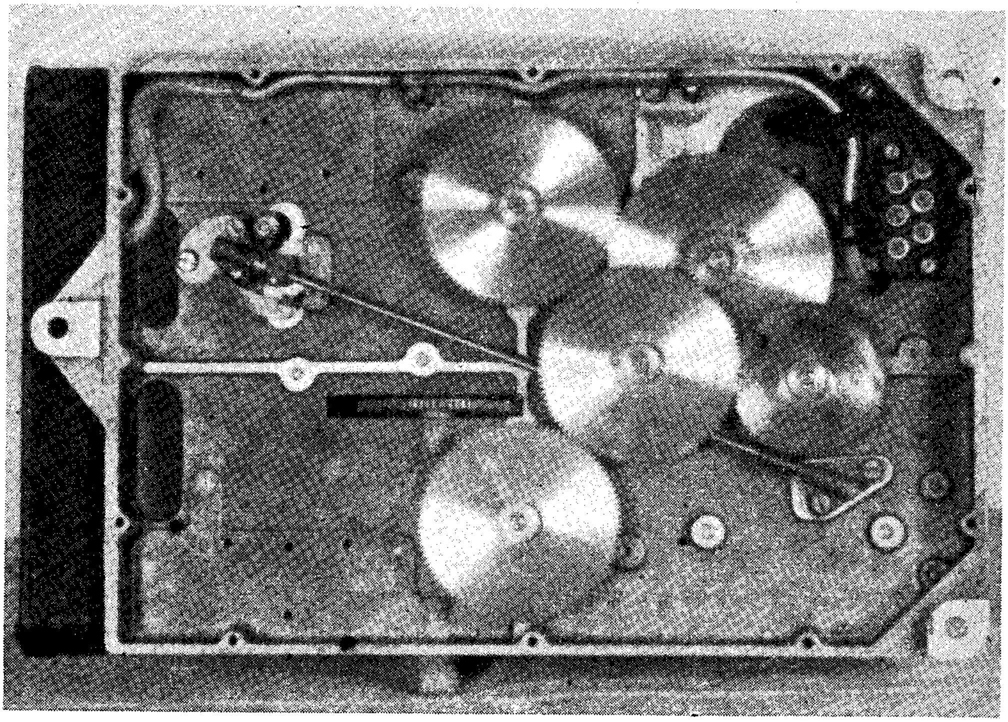
is automatically geared to correct the instrument for the convergence of the meridians at different latitudes.

For the guidance of readers who are interested in the components of these instruments when stripped down, it should be mentioned that they contain, in addition to the four counters, three complete friction gear units, and the repeater motor already mentioned, a large number of spur, bevel, and worm-wheels, one indicator lamp, with bayonet lamp holder, one tumbler switch and one push button.

Control of the output side is effected by means of two 24-volt shunt motors which run continuously, and drive the mechanism through ingenious reversing friction gearing. Unlike the gearing of the Air Position Indicator, however, this does not produce a variable ratio of speed. On each of the motor shafts is a hub which carries two flanges, in the form of flat discs, with smooth inner faces. Between these, and at right-angles to them, is a rubber-tyred disc, a little smaller in diameter than the distance between the flanges on the motor shaft. The shaft of this disc runs in bearings attached to a pivoted frame which can be swung either way to bring the tyre of the disc into contact with the inner side of one flange or the other. In this way, motion in either direction is transmitted to the disc shaft without stopping or reversing the motor. Only a very small side swing of the disc shaft is required to change it over, and this is obtained from a pneumatic diaphragm controlled by one or other of the "input" instruments. The motor thus acts as a servo-motor or mechanical relay to amplify or supplement the power of the controls.

The gyroscope of this instrument is air-driven, in similar manner to the instruments which have been described, but in this case it is a true directional gyro, and incorporates means of controlling the precession of its axis. This is done in an ingenious manner which merits a brief description here. The gyro is completely enclosed in a casing, which is kept under a partial vacuum,

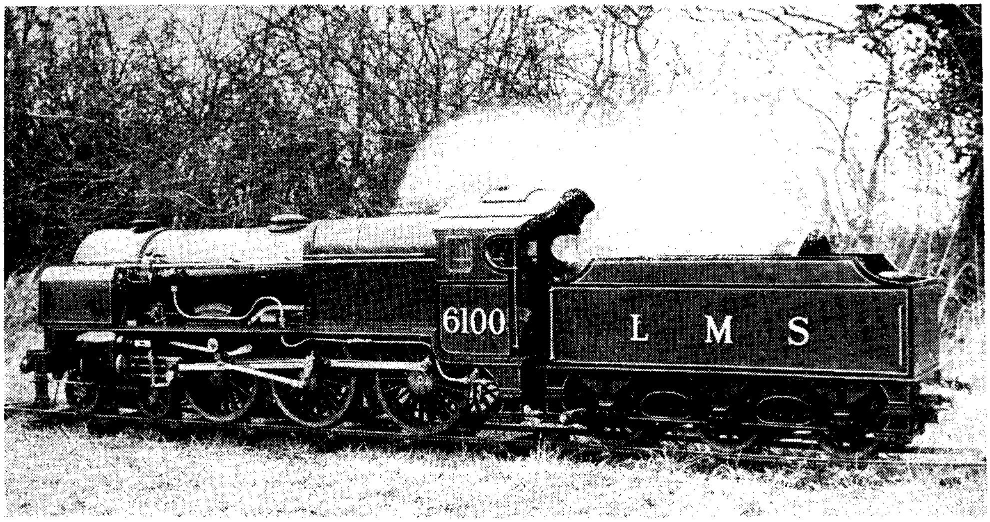
(*Continued on page* 435)



Underside of air position indicator, showing gear trains

Bomb Sight Computor

This is the most complex and elaborate instrument so far encountered in complete form. It was employed, as its name implies, for the automatic setting of bomb sights on a moving aircraft, taking into account all factors such as the speed of the craft, altitude, drift, and direction of flight. The ingenuity of the mechanism, which embodies mechanical, electrical, and pneumatic devices, is something to be marvelled at, and the number of high-precision components in it is enormous. No attempt is made to give an explanation of how it works, but it may be mentioned that the progress of the aircraft is recorded by a repeater motor, and its direction by an air-driven gyroscope; static and kinetic air pressures from pitot heads outside the craft are used to operate metal bellows or aneroid capsules which record airspeed, altitude, etc. All these constitute the "input" portion of the instrument.



A $7\frac{1}{4}$-in. Gauge "Royal Scot"

by L. Willoughby

TWO ardent model engineers have just finished their seventh model which far surpasses any previous attempt. The chief conspirator is Mr. C. Barnett, who lives well out in the country, down Hampshire way. His quiet, unassuming attitude is no more remarkable than his never-ending patience, and it is inspiring to note his confident manner when confronted with almost unsurmountable problems; nothing is too much trouble and no job too hard.

After having finished a L.M.S. 2-6-0 in $3\frac{1}{2}$-in. gauge, he began to cast around for something fresh, and feeling that $3\frac{1}{2}$-in. gauge was not suitable for his purpose he decided on $7\frac{1}{4}$-in. gauge. After prolonged enquiries, he found that the most likely type would be a L.M.S. "Royal Scct," as this was the only one for which castings could be obtained; even so, he first had to supply the patterns for steam chests and cylinders. A set of drawings was obtained from Mr. H. Greenly, and then commenced a crusade of begging, borrowing, exchanging, purchasing, making-do and scrounging in general for materials, etc., and this, in Mr. Barnett's own words, was worth a medal as big as "Big Ben."

After careful study, cur friend considered that the boiler would be the most formidable job and so this took priority. The barrel is solid-drawn copper tube 3/16-in. thick; the other plates are also 3/16 in. The firebox was riveted and brazed, tubes brazed, barrel and outer wrapper riveted and soft-soldered. I still cannot understand how he managed this job with the equipment at his disposal.

The footplate fittings were next made and, as the photo shows, are a masterpiece; in fact, the boiler and fittings are an example of excellent workmanship, hard work and patience. The boiler was tested, and this is where I came in, as Mr. Barnett kindly condescended to allow me to help him with the remainder of the construction of the loco. Water was pumped into the boiler to a pressure of 250 lb. per sq. in., and steam was raised to 150 lb. per sq. in. The most gratifying thing was that there was not a vestige of a leak anywhere; this is all the more pleasing because the stays are not caulked.

Mr. Barnett's workshop contains an 8-in. lathe, a large drilling machine, together with a hand-shaper and $3\frac{1}{2}$-in. lathe; whereas, my shop contains only a 4-in. lathe and small drill, and so I could take on the smaller work only. It was at this juncture that our young friend, Johnny Davis, came in handy as assistant draughtsman, as only one set of drawings was available and copies were required at both factories. Our workshops are 20 miles apart and this is where the "gasolene cart" was useful. Johnny has proved to be a very handy man in general. He is an expert driver, having taken his turn at driving my "Lord Nelson" during the last hectic years of her working career at fetes, etc. He has driven on several miniature railways on the south coast, and is becoming quite proficient in the use of tools.

We have spent some strenuous Sundays in my colleague's workshop, the worst snag being as mentioned above, the fact that we live over 20 miles apart, and considerable time was spent in the transportation of personnel and spare parts, etc.

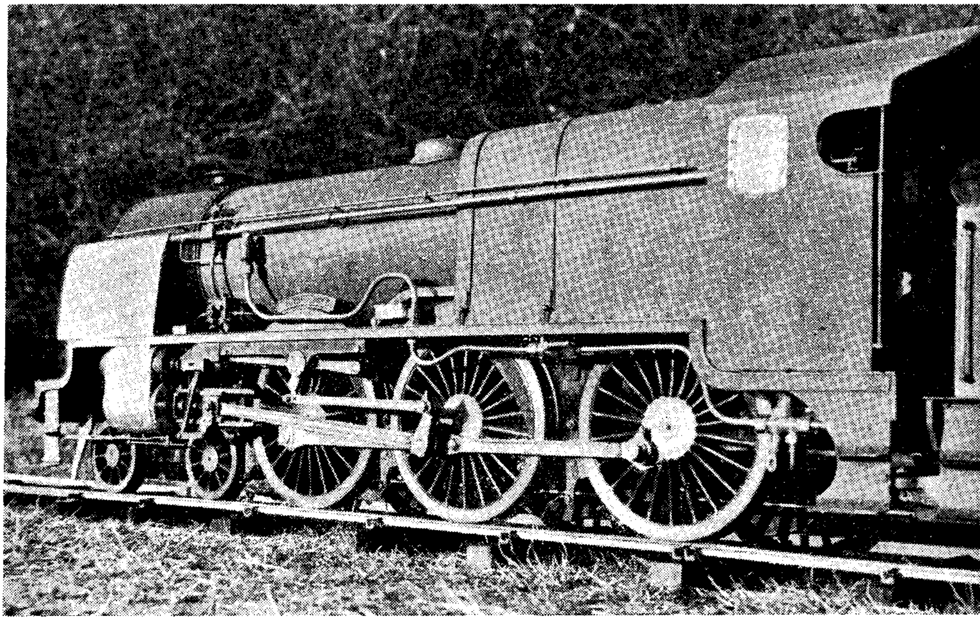
The main frames are 5 in. wide, and the material was 6 in. wide, and so Mr. Barnett spent two evenings sawing them down, two together,

5 ft. 6 in. long. Wheels were machined and balance weights fitted, as this was not provided for in the castings. The usual method was adopted, i.e. brass plates fitted to the side of the wheels, and the intervening space filled with lead. Connecting and side rods presented a problem as the material was $1\frac{1}{4}$ in. × $\frac{3}{4}$ in., 75 per cent. of which had to be removed. The workshop is supplied with electricity at 25 volts, generated by a 4-h.p. oil engine, which also drives the machines and so, mains supply was out of the question. Anyhow, we managed to get hold of an old motor fitted with a reducing gear, and after a fortnight's work (evenings and Sundays), it was fitted up on to the lathe to operate a $2\frac{1}{2}$-in. hollow mill. Another fortnight saw the rods beautifully finished and fluted.

The engine is an inside-admission piston valve engine, each valve-head being fitted with four rings and main pistons with three. The smooth finish of the steam-chests and cylinder-bores attracted considerable attention at exhibitions where they were shown. This was accomplished by special tools, made by my colleague, consisting of two emery-slips fitted in a holder and held against the bores whilst the casting was revolved in the lathe. The same tool could not be used for steam-chest and cylinder-bores owing to the difference in size, and so two such tools had to be made.

Considerable work was put into the smokebox as this houses the steam drier consisting of a nest of 16 small tubes, through which the steam passes on its way to the cylinders and becomes slightly superheated. The imitation vacuum ejector is made use of as the blower steam cock, the steam pipe making the operating rod from the cab.

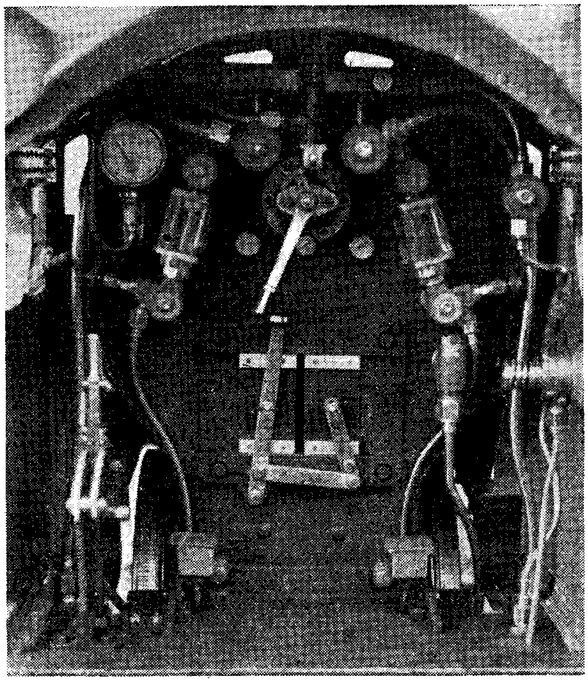
No difficulty was experienced with the valve-gear until it came to making the expansion-links, as the lathe would not take the radius necessary. Mr. Barnett's aptitude for accuracy would not allow them to be made by hand, as it would not come up to the standard which he desired; so a piece of steel plate 5/16 in. × 5 in. was rigged up on the face-plate and your humble then "signed on" to the belt and worked it to-and-fro, whilst the tool was fed into the cut, thus forming the radius in the box pattern link. This resulted in a perfect curve.



Steam brake is fitted with the usual type of disc-valve for control; the brake piston is provided with three rings. Two injectors were made and fitted as per "L.B.S.C."; but it was subsequently found that a larger size could be obtained and as these were more suited to the size of the boiler, it was decided to use them. "Shut-off" cocks are included in the delivery-pipes so that, in case of emergency, they can be shut off; the tender hand pump is fitted similarly.

The boiler is lagged with sheet asbestos and covered with 20-gauge brass; a little trouble was experienced with the covering of the Belpaire firebox owing to its shape. The tender is of the usual L.M.S. type, but the superstructure at the front is dispensed with so as to facilitate driving. Working hand brake and the flexible feed-water connections are provided. The tank is of 14-gauge brass sheet, and contains nearly 1,000 rivets.

About 250 ft. of track and six trolleys have been constructed. The track is made of $\frac{1}{2}$ in. × $\frac{1}{8}$ in. steel angle, with cross-members slotted to take the vertical side of the angle, spaced at 9-in. intervals and welded. Wooden sleepers were



screwed to the cross-members. Angle was used in the construction of the trolleys which seat four kiddies or three adults and run on ball-bearings. Patterns for bearing housings and buffers were home-made, together with a special trolley for transporting the engine from shop to road.

Whilst making the valve-gear components, it was realised that some method of drive for the mechanical lubricator would be necessary, and after several schemes had been discussed, it was finally decided that the best plan would be to take the drive off the inside trunnion of the left link; so this was drilled and tapped for an arm to which is attached the driving-rod. This method has proved very effective and neat.

There is still plenty of scope for experiment; for instance, we realise that trouble connected with "front end" lubrication is not uncommon, as the smallest piece of foreign matter under the check valves may cause a failure and it is very important, with an engine of this description, that the lubrication is adequate and consistent. The answer to this can be found in a sight-feed lubricator whereby the driver can see at a glance whether the engine is getting the oil properly. Moreover, this type of lubricator does not require check-valves, and so this potential failure is absent and the supply of oil can be regulated at will. Glancing through the pages of a recent copy of THE MODEL ENGINEER, we came across a description of a sight-feed displacement lubricator, which has been constructed by a reader and fitted to a $3\frac{1}{2}$-in. gauge G.W. model. We were rather taken with this, and decided to experiment; so provision was immediately made for the main steam-cock to be fitted on to the main turret before the cab was fitted. The chief attraction lies in the fact that check-valves are not necessary, and the majority of failures of the mechanical type are due to these.

The lubricator under review has been constructed with one or two modifications; the sight-feeds are fitted direct to the container, and the atomising-valve has been dispensed with. Steam and oil connections are made at the top of the sight-feed fittings, of which there are two, by means of a Y-shaped piece, and it is intended to fit the chokes at the front end near the steam chests so as to make them easily accessible, as we anticipate that the chief cause of failure will be caused by obstruction in the tiny hole through the choke. The lubricator is not yet fitted, but we are anxiously awaiting the results of our experiments. It is of ample size and can be accommodated on the footplate so that the driver has a good view of the sight feeds. Meanwhile, lubrication of valves and pistons is by a "mechanical" of Mr. Barnett's design; main axle boxes, slide bars and glands are fed from oil boxes attached to running-board.

Model engineers are generally "Jacks of all trades," but there is one trade in which this does not apply as far as we are concerned, and this is lining and painting the letters; so we had to call in the services of our old friend Mr. Pemble, who is the secretary of the Andover Society. He has kept up his reputation and made an excellent job of the painting and sign-writing.

After nearly two years' work, the "Day of Days" arrived, when the "new baby" was wheeled out of the shop for trials. The track was laid in record time and steam raised by means of an auxiliary boiler and blower, which is heated by a primus stove and is very efficient. Steam having been raised, the injectors were tried and found correct; steam brake valve was found to require a slightly stronger spring to keep it on its face; it was also found necessary to remove the gauge-glass protectors to obtain a better view of the water-level. The left clack stuck up full bore, so steam was let down and attention given. The hand-pump also had a bad leak in one of the unions.

Steam was again raised and, after the first run, the engine was found to be rather stiff, and a blow was distinguished at the chimney. However, after further runs the stiffness improved and the blow disappeared, which resulted in a vast increase in power. The engine pulls and steams well, and the exhaust beats are sharp and even. It is very gratifying to know that the valve setting is good, as this was done by sight, with the front valve cover removed.

The photographs were taken by Mr. A. Kavanagh, of Freefold, Hants.

Automatic Feed for "Adept" Shaper

by L. F. Bishop

THE essential features of this device are a ratchet-wheel and "pecker" to actuate the cross-feed screw, and a cam lever, operated by the ram, which travels across the machine with the ram, and is mounted with a sliding key on a rocking shaft running across the back of the machine.

The cam lever is shaped as in Fig. 1, and is depressed on the return stroke of the ram.

The whole of the rocker assembly is mounted on a foundation bar (omitted in sketch, Fig. 1) 1 in. × ¼ in. × 12 in.; this is held by the bolts that fasten the machine to the bench, being filed as necessary to sit down snug and square on the two hind "feet" of the machine.

two rear adjusting screw nuts of the ram, and engages the groove in the sliding sleeve.

The ratchet wheel is a ring turned from ¼-in. steel plate, with 30 teeth, bolted to the inside of the handwheel with 4-B.A. bolts. This wheel is made by marking-off and drilling a ring of 5/32-in. holes on a pitch circle, slightly smaller than the outside diameter of the handwheel, and after drilling the holes turning it away to leave only half holes, as in Fig. 3.

The "pecker" normally gathers two notches of the ratchet-wheel, but if a fine feed is required, an adjusting screw through the cam lever can be tightened; this limits the return of the cam lever, and then the pecker only takes

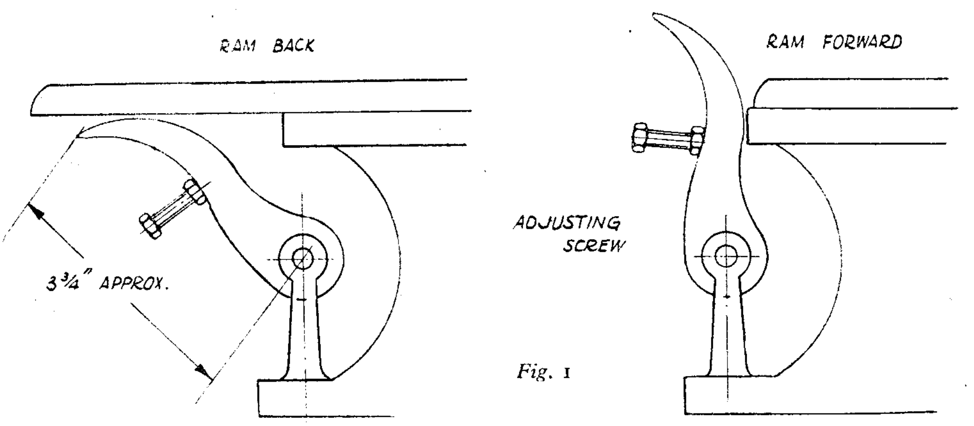


Fig. 1

At each end of the foundation bar is mounted a turned steel column, drilled through $\frac{5}{16}$ in. diameter to carry the rocker shaft. This shaft has a key-way planed along it (this can be done on the shaper, part at a time). It is necessary to keep the cam lever working on the centre of the ram all the time. This is done by clamping the cam lever on to a sliding sleeve, which has an inserted key engaging with the rocker shaft, and at the right-hand end (facing the machine) a groove is turned. A small plate shaped as in Fig. 2 is fitted under the

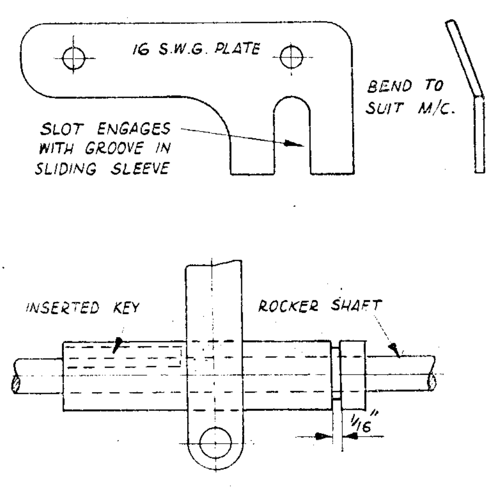


Fig. 2

one notch at a time.

The pecker is carried on a small arm clamped to the rocker shaft, and, of course, lines up with the ratchet wheel as in Fig. 4.

The pecker, as drawn in Fig. 4, would not work, it must be much shorter so as to "dig in" when thrusting.

On the extreme end (left-hand, facing machine) is clamped a small lever which has a return spring fixed to it, to keep the cam lever up against the ram. This may be either a "mouse-trap" type, or a spiral tension spring.

The layout of the rocker shaft is shown

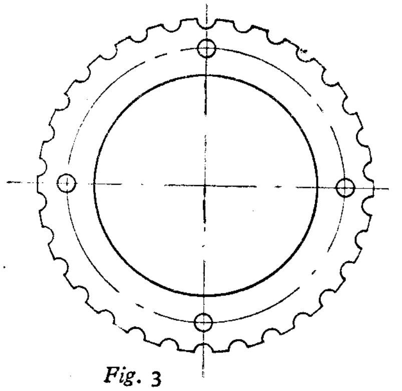


Fig. 3

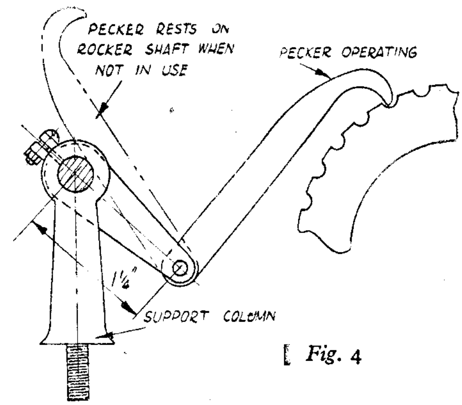


Fig. 4

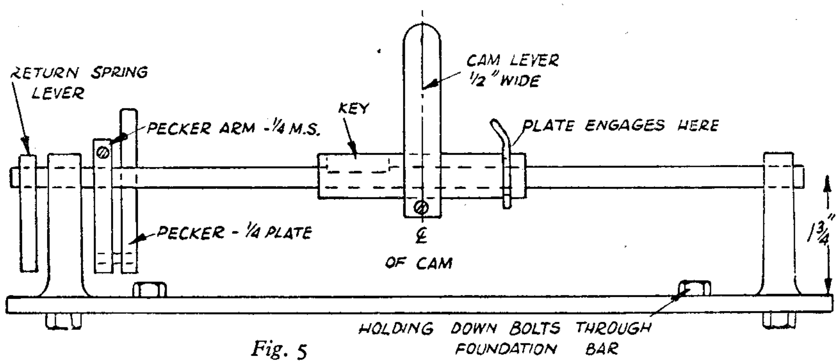


Fig. 5

in Fig. 5. All measurements are approximate; nothing is critical, and can be made up on job. The cam lever is best shaped by cutting out a few card templates, and offering them up, so that the cam trips just about half-stroke, on the return of the ram. The only really essential features are the "pecker," the sliding sleeve on the rocker shaft, and the cam lever clamped on to the sleeve so as to be always on the centre-line of the ram.

Swords into Ploughshares

(*Continued from page* 430)

but air is allowed to enter through a single small aperture leading into the bearings of the gimbal ring, and through passages in the gimbal frame to the jet which drives the rotor blades. After impinging on these, the air is allowed to escape from the rotor casing, into an outer collecting casing, through four slots at right-angles to each other. When the rotor assembly is vertical, each of these slots is partially closed by a light vane which is pivoted so as to hang in front of it. Thus the air, escaping under equally slight restriction from each of the slots, produces equal and opposite reactions in all four directions, and no tilting force is exerted on the gimbal bearings. If, however, the assembly swings or "precesses" out of the vertical, the vanes swing out of their normal position so that the effective aperture of one slot is increased while its opposite one is further restricted. Thus the equilibrium of the escaping jets of air is destroyed, and a reaction force produced, so as to influence the precessional motion of the assembly as required to maintain true directional control by the gyro.

The components of the bomb sight computor include the repeater motor, two 24-volt shunt motors with reversing friction gearing, the air-driven directional gyroscope, four metal bellows (one of which is exhausted of air and could thus be used in the construction of a barograph), four air-pressure diaphragms for operating the controls, various pneumatic fittings, spur, worm and bevel gears, and pulleys. There are two assemblies comprising slide frames and fine-thread lead-screws which could be used to make up a winding machine for very fine wires, as used in radio instruments, ignition coils, etc.

This does not by any means exhaust the number or yet the possibilities of the components in the instrument, which is housed on a central panel with enclosures both sides, in a tubular outer frame, and supported by four double anti-vibration rubber disc mountings.

(*To be continued*)

IN THE WORKSHOP

by "Duplex"

9—Drilling in the Lathe

ALTHOUGH at times the lathe is used as a substitute for the drilling machine and the drill is then mounted in the headstock chuck, whilst the work is supported by either the saddle or the tailstock; more often, the drill is held in the tailstock and is fed to the work revolving in a chuck mounted on the headstock mandrel.

Drilling from the Tailstock

As this operation is so constantly required when making small components, and because it causes so much difficulty to the less experienced, it will be dealt with in detail, for there are many traps and possibilities of error if correct methods are not adopted.

As a test, run a No. 30 drill for a depth of 1½ in. into the end of a piece of rod running in the mandrel chuck, and then part it off just short of the bottom of the hole; the degree of accuracy obtained will be apparent from the truth, or otherwise, of the remaining drill centre-mark when the work is revolved.

As a truly-drilled hole in a single instance may be the result of good luck, drill and part off several pieces in this way, and mount them on their bores between the lathe centres; if they are then spun with the finger, any errors of centring at either end will be revealed.

Another simple way of testing the axial truth of the bore, after drilling, is to insert the drill, shank foremost, into the hole and then start the lathe; if the drill is a fair fit in the hole, as it should be, its point will not wobble if the bore has been drilled truly.

If all the test-pieces are found to be accurately bored, it stands to reason that no revision of the methods used is required, but if the drilling has been done in a haphazard manner, it is more likely that some of the parts will have been bored considerably out of truth.

Let us, therefore, examine the requirements necessary to obtain consistently accurate results without fear of spoiling a component on which much time and trouble have been spent, prior to the final drilling operation.

Testing the Drill

In the first place, the tools must be right for the job. The drill, presumably of the twist or straight-flute pattern, must be sharp and have accurately-formed cutting edges. At this point, it should be emphasised that the free-hand grinding of small drills cannot reasonably be expected to give results of sufficient accuracy for really satisfactory drilling, and a well-designed drill grinding jig is essential for this purpose.

Although drills are inspected by the manufacturers before despatch, it occasionally happens that, where the examination has not been sufficiently rigid, a slightly bent specimen may be acquired.

Place the drill on the surface plate and then tip the plate slightly; if the drill is straight it will roll with an even motion accompanied by a sound of constant pitch, but a bent drill will vary in its rate of travel and the pitch of the sound emitted will rise and fall.

When the drill is mounted in the tailstock drill chuck, it may be found that it does not point exactly to the centre recess drilled in the work; if, after the drill has been turned through an angle of 180 deg. and the chuck re-tightened, the drill points in the opposite direction, then the drill is not straight.

Obviously, a straight drill will always point to the same point on the work, irrespective of

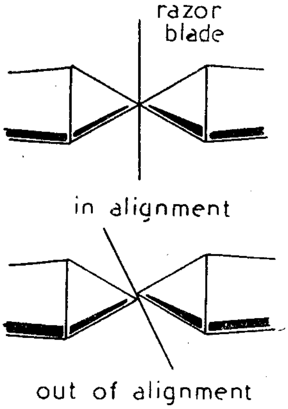


Fig. 1

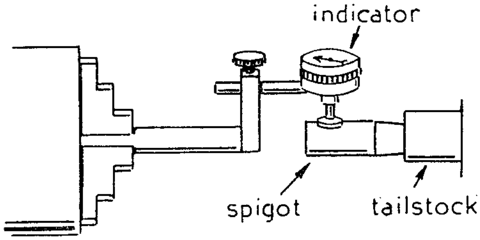


Fig. 2

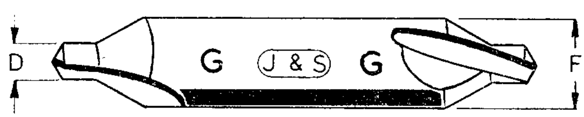


Fig. 3

its being turned in the chuck, and quite apart from any inaccuracy in the lathe or of the chuck itself.

Tailstock Alignment

The next point to check is the alignment of the tailstock, which should lie exactly in the lathe axis in conformity with the headstock and the lathe-bed guide surfaces.

Although, formerly, inexpensive lathes in some instances were much at fault in this respect, nowadays, the manufacturing methods used in producing reputable tools ensure that the components are correctly aligned.

two sets of recordings is then due to inaccuracy of the spigot fitting, and should be subtracted from the final result to give the actual location of the tailstock.

In the same manner, any obliquity of the tailstock setting can be detected by taking one set of readings at the base of the parallel portion of the spigot, and another set towards its tip; alternatively, the two sets of recordings can be made with the tailstock barrel in the closed and in the extended positions. Any discrepancy between these two sets of readings will disclose both the amount and the direction of any misalignment present.

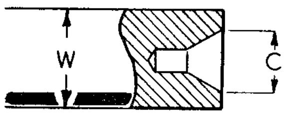


Fig. 4

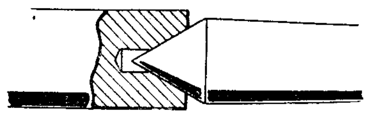


Fig. 5

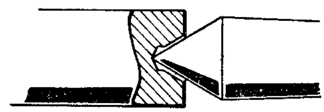


Fig. 6

As tailstocks are usually made to set over to the side for taper-turning work mounted between the lathe centres, it may be found that, when the drill is brought up to the centre hole drilled in the work, the drill point consistently lies to one side, indicating that the set-over should be adjusted to centralise the tailstock. But if, on the other hand, by some ill-fortune the drill is found always to point either above or below the centre-line, then it is best to refer the matter to the makers of the lathe. Furthermore, should the eccentricity of the drill point increase as the tailstock barrel is extended, then, presumably, the axis of the tailstock lies obliquely to the lathe axis and the advice of the makers should be sought.

A quick but reasonably accurate method, for most purposes, of adjusting the set-over of the tailstock to the lathe centre-line is to put the headstock and tailstock coned centres in place, and then to advance the latter until a safety razor blade is held between the sharp points of the two centres.

When the centres are truly in line, the blade should stand at right-angles, both vertically and horizontally, to the lathe axis, as illustrated in Fig. 1.

If a dial test indicator is available, it can be used as a ready means of setting the tailstock or checking its alignment.

The indicator is mounted on a rod projecting from the self-centring chuck, as shown in Fig. 2, and its contact point is brought to bear on a spigot inserted in the tapered bore of the tailstock barrel.

The inner guiding member of a tailstock die-holder will serve for this purpose, or the plain portion of the tailstock centre may be used. It is important that the tailstock barrel should be clamped with equal firmness whenever a reading of the indicator is taken. If the lathe mandrel is now turned by hand and readings of the indicator are taken at each quarter turn, any misalignment of the tailstock will be revealed, but as a check on the accuracy of the fitting used in the tailstock, this should be moved round half a turn and the readings repeated. Any variation between the

The test indicator can be more easily read, when in its inverted position, if a small mirror, or, preferably, a dental mirror with a handle is used.

So far, we have a set of correctly sharpened drills of known straightness and the tailstock has been accurately lined-up in the lathe axis. In addition, the drill chuck should be of good quality, and preferably of the Almond or Jacobs key-operated pattern; furthermore, the chuck must be mounted on an arbor which is an accurate fit in the tailstock barrel.

It now remains to mount the work in the headstock chuck, and, after it has been accurately faced so as to leave no centre pip, to proceed with the actual drilling operation.

The first step is to provide a guide centre in the work to locate the drill point at starting, for a small drill of full standard length has but little rigidity and may well fail to make a true start.

Centre Drills

This preliminary drilling operation is carried out with a short, rigid, centre drill of the type shown in Fig. 3.

As will be seen, the tip of this drill is formed in two parts: a slender, two-fluted, drilling or pilot portion, and a part of larger diameter acting as a 60-deg. countersink.

As these small tools are in constant demand for many machining operations, it may prove helpful to those not wholly familiar with their construction and use to describe them in some detail.

Although, as has been said, these drills are used for forming starting holes for drills, they are primarily intended for making accurate recesses to receive the lathe centres, as depicted in Figs. 4 and 5.

The 60 deg. countersunk hole exactly fits the coned lathe centre, whilst the narrow portion of the drill hole gives clearance for the sharp point of the centre, and, at the same time, forms a well for retaining the oil used to lubricate the tailstock centre.

The usual relationship between the size of

countersink (C) and the diameter of shaft (W) to be turned between centres is shown in Fig. 4; it will, however, be appreciated that the size of the countersink should, in part, depend on the amount of subsequent machining required on the shaft. If a few light cuts only are to be taken, the drilled centre may well be small to maintain the good appearance of the work, but,

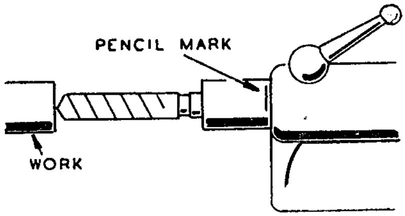


Fig. 7

on the other hand, where heavy machining is necessary the size of the bearing for the centres should be proportionately enlarged to resist wear and give additional support during the turning operation.

In the following table the standard sizes of a number of centre drills are listed, and Fig. 3 indicates the dimensions to which the letters used in the table refer.

U.S.A.

Size	Diameter of Pilot. D	Diameter of Body F	Approx. revs. per minute
A	3/64 in.	1/8 in.	5,000
C	1/16 ,,	13/64 ,,	4,000
D	5/64 ,,	15/64 ,,	3,300
E	3/32 ,,	3/10 ,,	3,000
F.1	5/32 ,,	7/16 ,,	1,700
F.2	3/16 ,,	7/16 ,,	1,400

British

	3/64 in.	1/8 in.	5,000
	1/16 ,,	3/16 ,,	4,000
	3/32 ,,	1/4 ,,	3,000

The importance of accurately centring the drill has already been stressed, and if this is not observed in the case of a centre drill, the slender pilot portion may be broken off when it is pressed into contact with the work.

The work should, if possible, be run at a speed suitable for the diameter of the pilot, as shown in tables of recommended twist drill speeds and indicated for some drills in the table above. However, in the case of the smaller drills, these speeds are not usually obtainable with the normal lathe drive, and great care must be taken not to overfeed the drills when lower speeds are used.

Whatever the speed used, the drill should be kept well lubricated with lard oil or other cutting fluid, light cutting pressure only should be applied, and the drill should be backed out of the hole to clear the chips immediately it shows any signs of not continuing to cut freely.

Although centre drills cut freely when their cutting edges are sharp, more pressure is required to feed them into the work once they become blunted; for this reason the pilot portion, particularly in the smaller sizes, is easily twisted off if the drills are not kept sharp.

The cutting edges of the pilot drill can be readily sharpened in a twist drill grinding-jig, but the setting of the caliper gauge to give the correct back-off must be found by a process of trial and error, and when found should be noted for future reference.

With care, these drills can be resharpened several times before the pilot becomes too short to be of service for drilling running centres. The effect of using an unduly shortened drill is shown in Fig. 6, where it will be seen that the tip of the lathe centre bottoms in the hole and the coned portion offers no proper support to the work.

Pilot Drilling

As has already been pointed out, the successful drilling of axial holes in revolving work depends on adopting a methodical way of working, and not leaving the outcome to chance. Although there are, no doubt, many different ways of doing this work, and individual workers have their preferences based on past experience, the following method has been in use for many years past and has given consistently good results.

After the end of the work has been accurately faced, the fast speed of the lathe is engaged, and a centre drill with a $\frac{1}{8}$ in. diameter body is mounted in the tailstock drill chuck. This drill is then carefully fed into the work until the body portion has entered for a distance of at least $\frac{1}{8}$ in.

It should be noted that, when the tip of the drill first engages the work, only very light feed

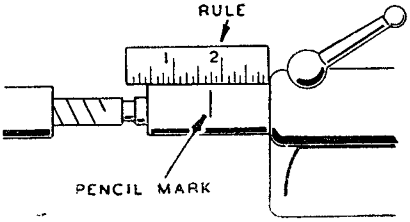


Fig. 8

pressure should be applied, to enable the drill point to form a central bearing for itself and not be pushed aside by any slight unevenness of the work surface.

The centre drill is followed by a $\frac{1}{8}$-in. twist-drill, which will be found to be a good fit in the hole already drilled, and so will obtain proper guidance for both the cutting edges and the sides of the drill point.

The drill selected for this purpose should preferably be of the high-speed steel variety, and should have a narrow edge at its extreme tip to reduce, as far as possible, the pressure required to feed it into the work. Needless to say, as already stressed, the drill should be really sharp, with accurately formed cutting edges.

It is important to make sure that the chuck jaws are firmly tightened on the drill shank, otherwise, should it turn in the chuck during the drilling, the shank will be roughed-up and it will then be difficult to hold it truly ; likewise, the taper spigot of the chuck arbor must be firmly engaged in the tailstock barrel to prevent its slipping and causing damage to the contact surfaces.

This $\frac{1}{8}$-in. drill is fed into the work for the required depth, and in so doing, it should not be crowded into the work by using too heavy feed pressure, for this will tend to bend the drill and divert its point from following a straight path.

If a deep hole is being drilled, the drill should be frequently withdrawn from the work and then lubricated, and the chips removed by the application of an oily brush.

Should a hole of smaller diameter than $\frac{1}{8}$ in. be required in the work, either a short, stiff drill of the correct size should be used for the initial drilling operation, or the pilot portion of a centre drill of the right diameter may be used to form the guide hole for the longer and more flexible drill which follows.

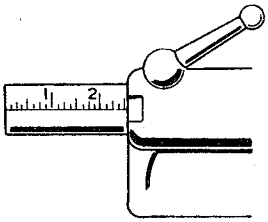


Fig. 9

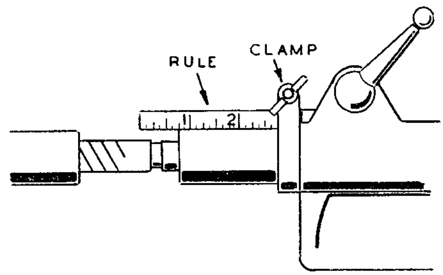


Fig. 10

When the diameter of the hole required is larger than $\frac{1}{8}$ in., the preliminary pilot drill is followed by one or more larger drills to bring the bore up to the final diameter desired.

Before starting the larger drill in the pilot bore, the outer end of this hole should be countersunk with a large centre drill up to a diameter at least equal to that of the following drill.

This procedure allows the drill lips to obtain better guidance, at starting, from the coned surface of the countersunk hole than they otherwise would when meeting the sharp edge of the parallel bore. In the same way, if the second drill is to be followed by a third, the mouth of the hole should again be suitably countersunk.

As, in many instances, drilling to an exact depth is essential, and it is a tiresome business to have to insert a rod into the hole and then measure its depth of entry with a rule, some exact means of registration as drilling proceeds is a great convenience.

The simplest and most primitive method is to make a pencil mark on the tailstock barrel when the first drill engages the work, as illustrated in Fig. 7, and, during the course of the machining the distance between the mark and the end of the tailstock casting is measured with a rule, as shown in Fig. 8.

In this connection, it should be noted that the ordinary grease pencil, used in chemical laboratories for writing on glass, will mark clean metal surfaces equally well and will, in consequence, be found of the greatest use for many purposes in the workshop.

A more workmanlike method of depth drilling is to provide the tailstock barrel with graduations, as shown in Fig. 9, so that the depth of penetration of the drill can be read directly with reference to the machined ends of the tailstock casting.

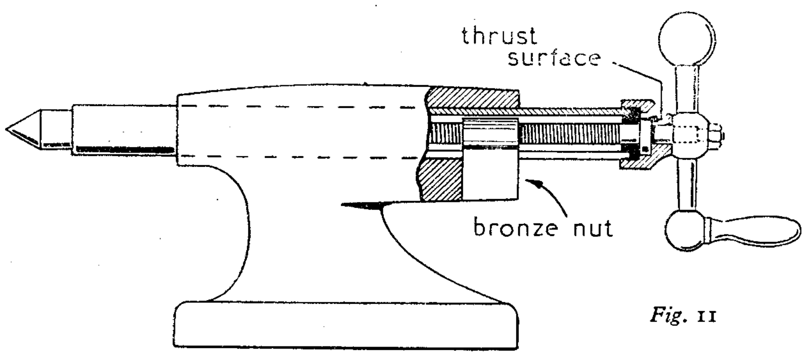


Fig. 11

Although the practice of graduating the tailstock barrel has been generally adopted by manufacturers, this is not always the case, and in a future article this subject will, it is hoped, be considered from the practical standpoint, showing how the lathe itself can be used to space and cut the graduations with great accuracy and with a high finish.

A method adopted by the writers' for depthing the drill hole, as applied to an old lathe, may be

of interest. It was found that a narrow 4-in. Starrett rule would slide in the slot that was cut in the tailstock casting to allow the latter to secure the tailstock barrel, when the clamping screw was tightened.

As shown in Fig. 10, this rule was kept in place by means of a clip encircling the end of the tailstock casting, and when the clip was closed by tightening the wing-nut, the rule was firmly secured. To enable the clip to bed properly the end of the tailstock casting was turned parallel for a short distance.

To use the device: the point of the drill was engaged with the work, the clip was slackened, and an inch mark on the rule was moved level with either the end of the tailstock barrel, or with a line marked thereon. This enabled the progress of the drill to be read off directly on the scale.

This simple appliance had the advantage that, unlike the graduated tailstock barrel, the zero position could be readily set as required.

Tailstock Feed Mechanisms

Before leaving the subject of drilling from the tailstock, some mention should be made of the effect tailstock design has on feeding the drill into the work.

In the form of tailstock fitted to precision lathes, illustrated in Fig. 11, the barrel, which is lapped to fit the tailstock body with great accuracy, is actuated by means of an internal feed-screw engaging an inset, finely threaded, bronze block.

The parts are usually so well fitted that the feed handle can be spun wth the finger, and the barrel moves forward comparatively slowly owing to the fine pitch of the feed-screw.

The result of this construction is that but little resistance is felt when feeding the drill.

In the drilling machine, too, the leverage provided by the feed mechanism is such that great pressure can be applied to the drill point with but little manual effort.

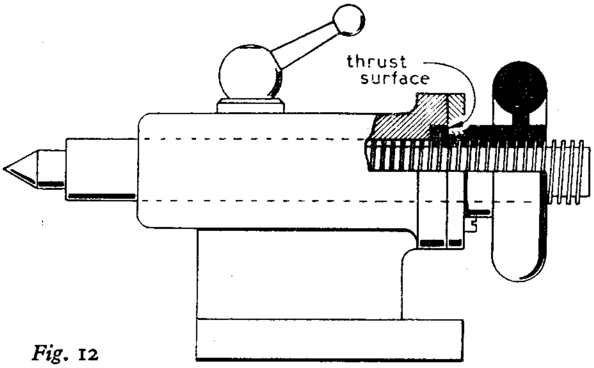


Fig. 12

The construction of the more usual type of tailstock fitted to general purpose lathes is shown in Fig. 12.

Here, both the plain and the screwed portions of the barrel are of equal diameter to fit the tailstock body, and the thrust is taken against a shoulder of large diameter machined on the hand-wheel collar.

This results in considerable friction arising at the thrust surfaces when the axial load is imposed, as in drilling. So much so, that, in some cases, even a drill as small as $\frac{1}{8}$ in. in diameter gives the impression of being blunt, whereas, in reality, the feed pressure is being largely dissipated in the friction set up in the thrust mechanism.

This can readily be checked by mounting the same drill in the drilling machine and applying the normal feed pressure.

In one instance, the writer's fitted a ball-thrust collar to a tailstock of this type, with the result that whereas, before, the tailstock was unable to exert a measured pressure of more than 20 lb., after the conversion 40 lb. pressure could be applied without difficulty, and drilling became normal and reasonably sensitive.

In some tailstocks this conversion is quite easily carried out, but in others there is hardly sufficient space in which to fit a ball-thrust collar.

(*To be continued*)

A "Double" Repulsion Motor

(*Continued from page* 426)

the connections, i.e. shorting out the field and applying current to the brushes, with little effect beyond re-introducing the radio interference trouble. After more head-scratching, I reasoned that the lack of torque was due to the fact that only half the armature winding was doing any work, the low voltage end being in effect a "passenger." Under these conditions, the induction effect would be too small and consequently torque was also low. The obvious solution was to make the low voltage armature winding "work its passage," so the brush-shorting process was repeated on the low voltage end of the motor so that the whole system was now as shown in Fig. 2.

After a little experimentation to find the best brush positions, the motor was found to give a very good performance, and has, for the last nine months, been actively employed in driving a $2\frac{1}{2}$-in. lathe, a job for which its speed-torque characteristics do not make it eminently suitable, but which it has none-the-less tackled in a very satisfactory manner.

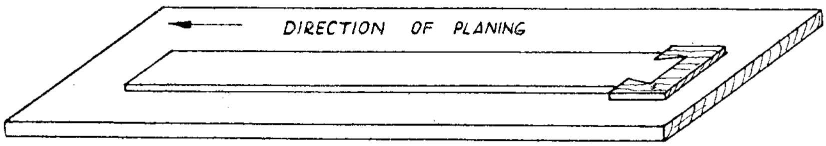
Just one hint to those who might be thinking of trying this system—the low voltage brushes are of large section, and it is quite easy to use up the hard-won extra torque in overcoming commutator friction, so make sure that the brush-spring tension is as light as possible, consistent with avoiding any trace of brush "bounce."

Editor's Correspondence

Planing Thin Material

DEAR SIR,—I was very interested in the letter published in the March 4th issue of THE MODEL ENGINEER on the subject of "Planing Thin Material." Perhaps the following remarks will be of some help to Mr. Bettles and anyone who requires to plane thin planks :—

First, it will be apparent that to plane any piece of thin wood such as is required for model planking, some method must be used to prevent buckling, and the method I use on planked ship models eliminates this entirely. Instead of *pushing* the plank against a stop, I secure the wood from the other end by means of a dovetail-shaped notch cut in the end of the plank. In this way the length of wood planed is only limited by the length of the bench or supporting board.



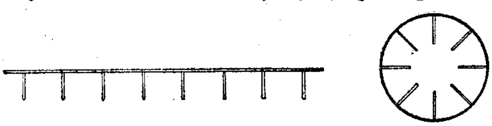
Planing should be done by a Stanley smoother, if possible, sharpened until it is able to shave hairs from the back of the hand! Wax the sole of the plane. The planing board can be about 3 ft. long × 9 in. × 1 in., planed dead flat. The dovetail-holder is made from beech or any similar wood, grain in direction of lines, and can be made to rise and fall in the main board. It will be realised that it is only a few seconds' work to notch each board, and the boards can be multiples of the required length.

The method used by Mr. R. L. Sweatman, although it works for short lengths, would be useless on planks of, say, 2 ft. or 3 ft. long. I give a rough sketch and description which may be of some use to Mr. Bettles; and in conclusion may I congratulate him on a very fine piece of work. I had the opportunity of inspecting it at the 1947 MODEL ENGINEER Exhibition.

Yours faithfully,
Kempston. MAURICE WHITTAMORE.

Road Locomotives

DEAR SIR,—Mr. Geo. Cawthorne in his most interesting and informative letter on this subject in your issue of February 19th, quoting Mr. Peffer, refers to the engines having "copper fireboxes with brass 'serf' tubes." I may be wrong, but I imagine these are probably "servé" tubes, at one time very popular on French locomotives. They were tubes with internal ribs and were made from flat strip rolled up and welded along the seam. Their design was based on the fact that a given area of heating surface on the "water" side can radiate more heat than a like area can take up on the fire side. Their use accounted for the very high figures for tube heating surface, frequently noted on locomotives fitted with them. I would be greatly interested to know if my surmise is correct; the more so, as this is the only case I have come across of their application to road locomotives. If I am wrong, it would be interesting to know what the "serf" tubes were.



Yours faithfully,
Wealdstone. K. N. HARRIS.

Ex-R.A.F. Air Compressors

DEAR SIR,—I recently purchased an ex-R.A.F. air compressor—the type which appeared in the advertisement columns of No. 2436 of THE MODEL ENGINEER. As it was the first time I had seen one of these remarkable little machines, and as no instructions were furnished with it, I was rather at a loss to know how to handle it, until I rather unexpectedly came across all the data I required in a friend's notebook; my friend being an ex-airman.

In case other readers may find themselves in a similar plight, I give the following information, taken from this ex-R.A.F. fitter's notebook.

B.T.H. Air Compressor—Types AV, AVA, AV3 and AV3A

The pump is a single-cylinder, single-acting, single-stage, reciprocating type.

Capacity.—40 cu. in. per min. at 200 lb. sq. in. pressure at 1,200 r.p.m.

Maintenance.—(1) Clearance between cross-head, and clocks should be 0.002 in. and 0.006 in.

(2) Clearance between piston-head and valve assembly 0.002 in.-0.004 in. (This is adjusted by shims beneath valve assembly.)

(3) Use castor oil for lubrication. Fill through orifice exposed by removing inlet valve, until oil runs out of hole in rear cover by depressing spring-loaded plunger situated there.

Defects in Working

Lack of pressure may be due to :—

(1) Too low an oil level in crankcase or oil seal.
(2) Broken inlet valve-spring.
(3) Dirt on inlet valve-seat.
(4) Gauze blocked up.
(5) Incorrect assembly of relief-valve assembly, or dirt on seating.
(6) Loose connections or hexagon cap on top of pump not making an air-tight joint.

Yours faithfully,
Tunbridge Wells. R. H. TYLER.